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COUNTRY USSR

8 JAN 1966

REPORT

SUBJECT

MI-6 Operating and Maintenance
 Manuals

DATE DISTR

29 December 1965

NO. PAGES

1

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REFERENCES

DATE OF
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technical manual

entitled "MI-6 Helicopter Powered by D-25V Turbo-Rotos Engines," (in the English language) prepared by the USSR for operation and maintenance of the Soviet MI-6 helicopter. The manual consists of three books as follows:

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Book I

Description; Main Data and Characteristics;
 Operating and Piloting Instructions

Book II

Description: Helicopter Construction

Book III

Operating and Maintenance Instructions; Loading
 Instructions; Helicopter Armament Description
 and Operating Instructions

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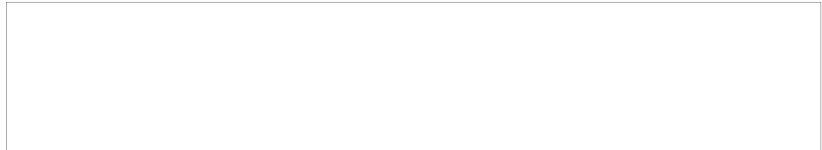
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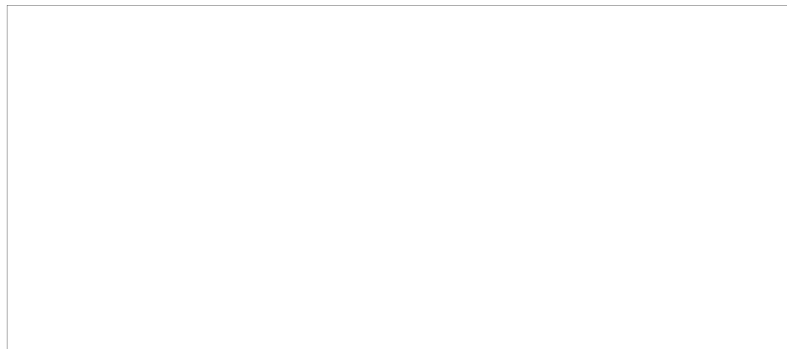


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MH-6 HELICOPTER Powered by A-25B Turbo-Rotor Engines (C)

Book I

DESCRIPTION
MAIN DATA AND CHARACTERISTICS
OPERATING AND PILOTING INSTRUCTIONS



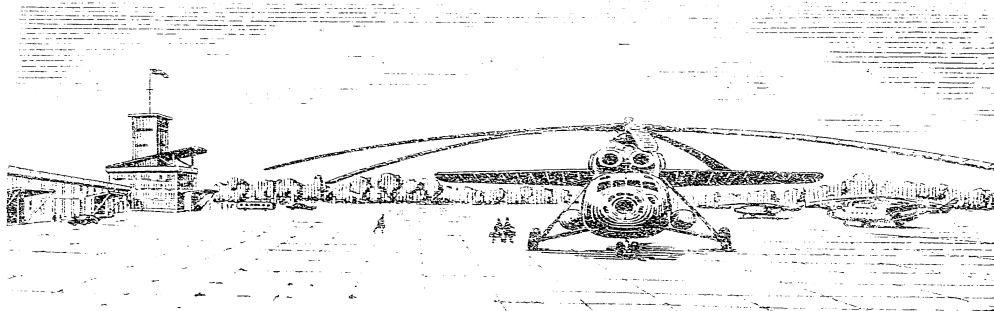
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Chapter I

GENERAL

The Mi-6 helicopter designed by M.I. Mil is intended for lifting cargoes and, when necessary, for transporting passengers. The helicopter may carry out transport missions in areas difficult of access, making landings at confined ground spaces without landing strips.

The Mi-6 helicopter is a single-main rotor machine equipped with a tail rotor (Figs 1, 2, 3, 4, and 5). Shown in Fig. 6 is the general view of the helicopter in three planes. Fig. 7 presents the arrangement diagram of the helicopter.

To reduce the load imposed on the main rotor, the helicopter carries a controllable wing which may be fixed in two positions. At all power ratings of flight the wing is fixed at the incidence angle of $+14^{\circ}15'$ relative to the datum line (the specified angle magnitude refers to the port wing panel). In case of transition to autorotation, the FMK-1 hydraulic mechanism changes the incidence angle and fixes the wing at $+4^{\circ}15'$. Since the air flow induced by the main rotor is asymmetrical, the incidence angle of the starboard wing panel is $1^{\circ}30'$ more than that of the port wing panel.

The helicopter is powered by two turbo-rotor engines A-25B designed by P.A. Solov'yev with free turbines which may develop the total power of 11,000 h.p.

The helicopter has a five-bladed main rotor and four-bladed tail rotor. The landing gear is of the three-wheel type.

The helicopter crew includes a pilot, co-pilot, navigator, flight engineer, and radio-operator, all the crew members having specially-equipped stations.

The helicopter carries electrical, radio, special equipment, and instruments, which ensure day and night flying in adverse weather conditions. Besides, the helicopter has a three-channel autopilot which makes it possible to exercise angular velocity, pitch, roll, and yaw control.

For carrying out transport duties, the helicopter mounts special cargo-handling equipment and loading ramps.

Large-size cargoes with the total weight up to 8 tons may be attached externally on a special sling.

In the cargo compartment provision is made for arrangement of quick-detachable seats for 55 persons.

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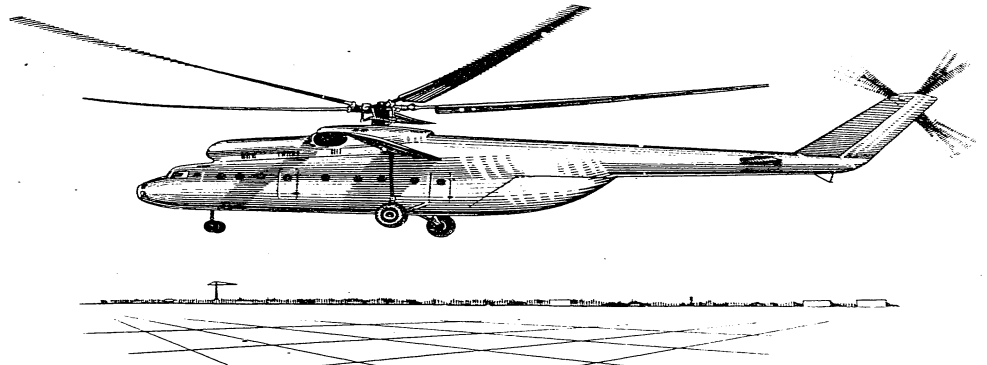


FIG.1. HELICOPTER Ми-6 IN FLIGHT

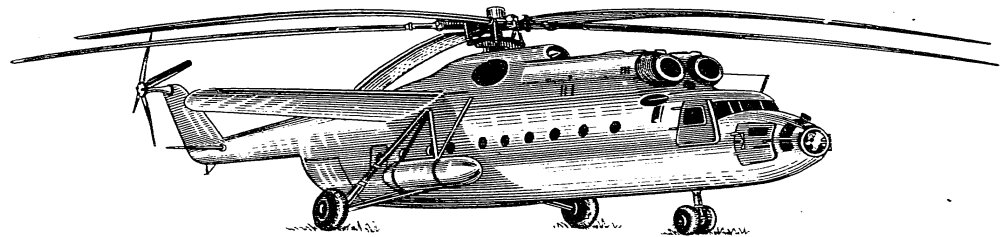


FIG.2. HELICOPTER Ми-6 (3/4 FRONT VIEW)

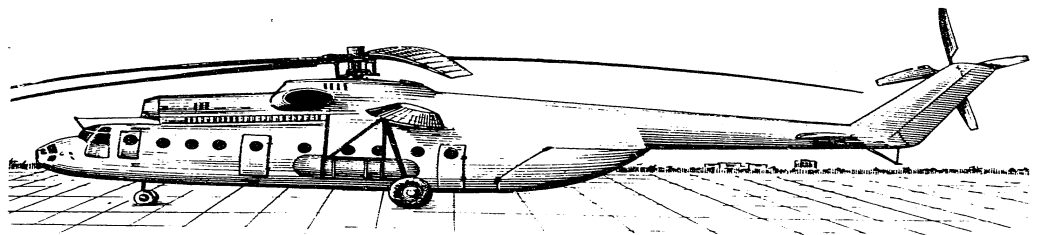


FIG.3. HELICOPTER Ми-6 (SIDE VIEW)

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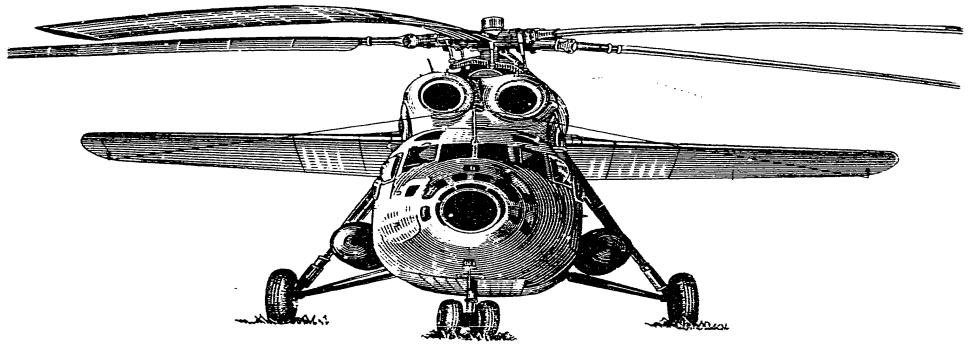


FIG.4. HELICOPTER Ми-6 (FRONT VIEW)

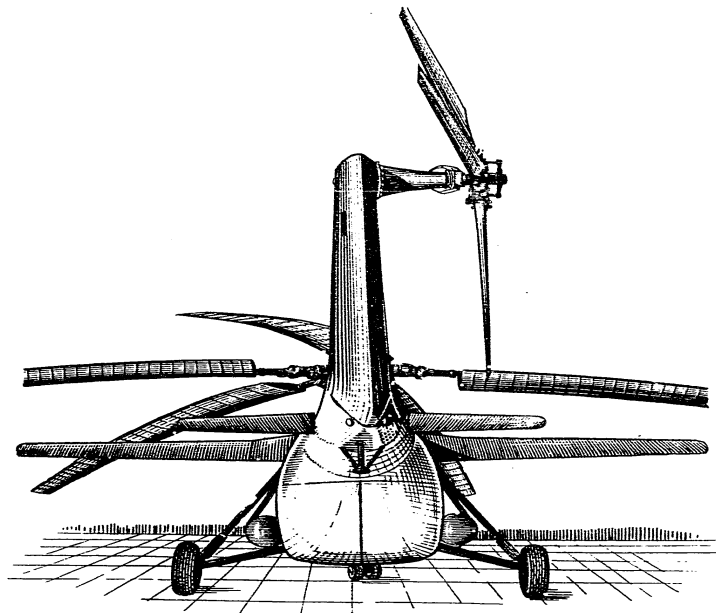


FIG.5. HELICOPTER Ми-6 (REAR VIEW)

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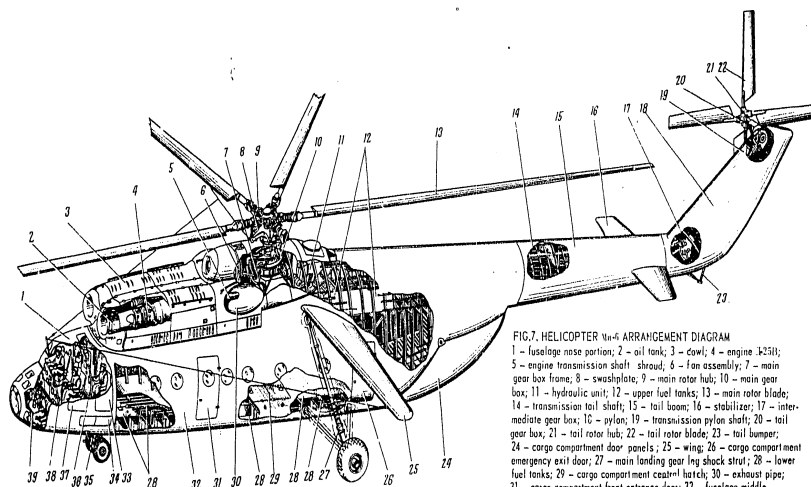


FIG.7. HELICOPTER UH-4 ARRANGEMENT DIAGRAM
 1 - fuselage nose portion; 2 - oil tank; 3 - cowl; 4 - engine; 5 - engine transmission shaft shroud; 6 - fan assembly; 7 - main gear box frame; 8 - swashplate; 9 - main rotor hub; 10 - main gear box; 11 - hydraulic unit; 12 - upper fuel tanks; 13 - main rotor blade; 14 - transmission tail shaft; 15 - tail boom; 16 - stabilizer; 17 - intermediate gear box; 18 - pylon; 19 - transmission pylon shaft; 20 - tail gear box; 21 - tail rotor hub; 22 - tail rotor blade; 23 - tail bumper; 24 - cargo compartment door panels; 25 - wing; 26 - cargo compartment emergency exit door; 27 - main landing gear leg shock strut; 28 - lower fuel tanks; 29 - cargo compartment ceiling hatch; 30 - exhaust pipe; 31 - cargo compartment front entrance door; 32 - fuselage middle portion; 33 - radio-operator and flight engineer's cabin emergency exit door; 34 - cover for storage battery container recess; 35 - landing gear nose leg shock strut; 36 - radio-operator and flight engineer's cabin; 37 - pilots' cabin emergency exit door; 38 - pilots' cabin; 39 - navigator's cabin.

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When in cargo variant, the helicopter can carry different machines, equipment, and other types of load.

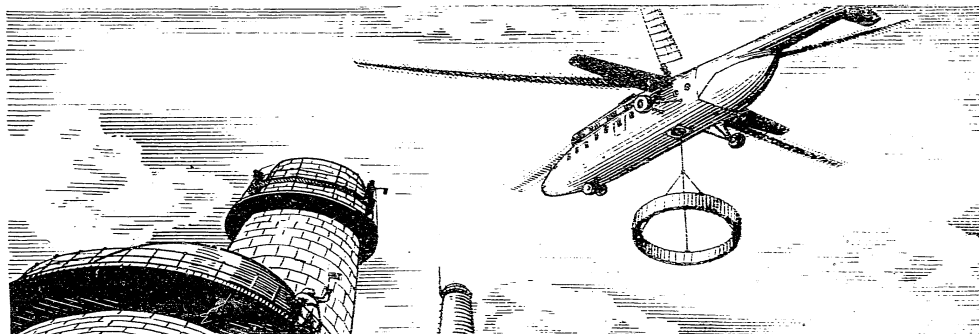
BASIC FLIGHT PERFORMANCE DATA

Maximum level speed	300 km/hr
Cruising speed with normal flying weight (at altitude of 2000 m) ..	250 km/hr
Minimum speed (at sea level)	0
Maximum altitude of flight with normal flying weight	4500 m
Maximum altitude of flight in overload variant	3000 m
Time of climbing (at normal rating):	
to altitude of 1000 m	2.0 min
to altitude of 3000 m	7.0 min
to altitude of 4500 m	19.5 min
Range of flight at cruising speed with normal fuel amount	
of 6315 kg at altitude of 2000 m (with 5% unusable fuel)	638 km
Range of flight at cruising speed and altitude of 2000 m with	
additional fuel in two external tanks. Total amount of fuel	
equals 9805 kg (with 5% unusable fuel)	1040 km
Endurance of flight at economical speed of 160 - 180 km/hr	
with normal fuel amount of 6315 kg	2 hr 50 min
Carrying capacity:	
in normal variant	6000 kg
in overload variant	8000 kg
in overload variant with decrease of fuel	
amount ($G_{fuel} = 2315$ kg)	up to 12,000 kg
on sling system	up to 8000 kg

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Chapter II

GEOMETRICAL, ADJUSTMENT, AND KINEMATIC DATA

GENERAL DATA

Helicopter length:

without main and tail rotors	33.165 m
with main and tail rotors rotating	41.739 m
minimum length with both rotors at standstill	37.490 m
Length from fuselage nose to main rotor shaft axis	10.833 m
Length from fuselage nose to fuselage-to-tail boom joint	21.345 m
Fuselage maximum width (external)	3.200 m
Tail boom maximum diameter	1.760 m
Tail boom length	6.290 m
Distance from fuselage lowest point to ground (ground clearance) with normal flying weight	0.596 m
Ground angle	2°
Minimum height of helicopter with normal flying weight and tail rotor at standstill (at parking site)	9.155 m

WING

Wing span	15.3 m
Wing area	35 m ²
Wing incidence angles relative to datum line (for port wing panel):	
in powered flight	14°15'
in autorotation	4°15'

STABILIZER

Stabilizer span	5.03 m
Stabilizer area	4.87 m ²
Angle of stabilizer deflection (relative to datum line):	
up	+6°10'
down	-30°
	-14°30' to 130°

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MAIN ROTOR

Main rotor span	35 m
Number of blades	5
Sense of rotation	counterclockwise (as viewed from below)
Disc area	960 m ²
Solidity	0.091
Disc loading	41.0 kg/m ²
Blade de-icing system	electrothermal
Blade droop angle:	
when resting upon blade droop centrifugal limiter pawl	2°
when resting upon jimbai attachment	8°
Maximum flap angle	25°
Blade angle (as checked against blade angle indicator on instrument panel):	
minimum	1°
maximum	13°30'±30'
Angle of blade deflection in main rotor plane (to be measured from plane normal to flapping hinge axis):	
forward	16°
backward	18°
Swashplate tilt angle:	
forward	7°18'±12'
backward	5°36'±12'
starboard	3°54'±12'
port side	5°24'±12'
Tilt of main rotor axis relative to normal to datum line	5° forward

TAIL ROTOR AB-63B-X6B

Tail rotor span	6.3 m
Sense of rotation	clockwise (as viewed upon tail gear box flange)
Number of blades	4
Blade angles:	
with right pedal on the stop	+23°±30'
with left pedal on the stop	-9°±30'
Blade de-icing system	electrothermal

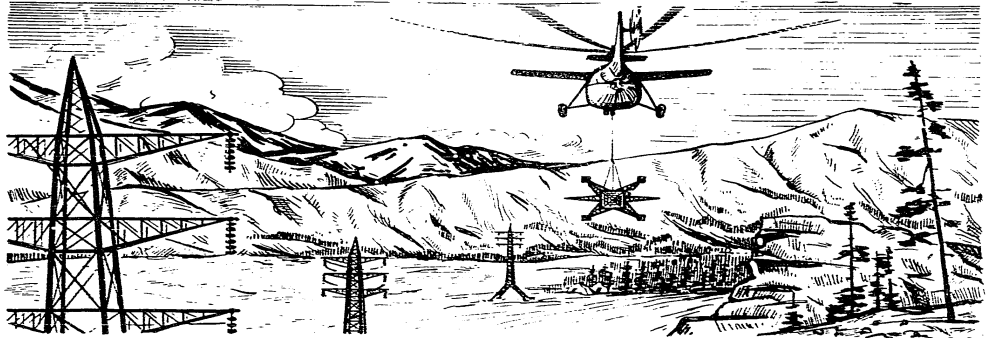
LANDING GEAR

Type	three-wheel, non-retractable
L.G. tread	7.502 m
L.G. base	9.095 m
Wheel dimensions:	
nose wheel	720x310 mm
main wheels	1325x400 mm

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Chapter III

WEIGHT AND BALANCE DATA

The helicopter weight and balance data for main variants of loading are cited in Table 1.—For data applied to this helicopter see supplement №2.

WEIGHT AND BALANCE DATA FOR DIFFERENT
VARIANTS OF HELICOPTER LOADING

Table 1

Weight and balance	Variant		
	transport	transport with increased range	with load on sling system
Weight of empty helicopter, kg	26,678	26,905	26,903
CG position, m	-0.321	-0.317	-0.316
Gross weight, kg	13,045	12,815	10,597
Gross weight components:			
Crew, kg	450	450	450
Oil, kg	280	280	280
Fuel ($\gamma=0.775$), kg	6315	9805	1867
Payload, kg	6000	2280	8000
Normal all-up weight, kg	39,723	39,720	37,500
CG position, m	0.007	-0.086	-0.043
Additional load in ferry variant, kg	2000	2000	-
Overload all-up weight, kg	41,723	41,720	-
CG position, m	0.065	-0.025	-

Table 1 gives the helicopter CG positions only in the longitudinal direction since variations in the CG positions in the vertical direction are of no practical importance.

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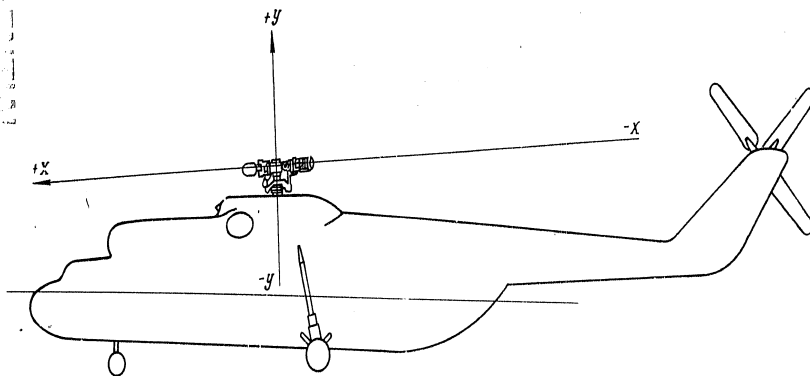


FIG.8 REFERENCE FRAME

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Commonly, the CG positions in the lateral direction are not computed. However, one should bear it in mind that loads in the helicopter cargo compartment should be arranged symmetrically. If the configuration of loads makes their symmetrical arrangement impossible, be sure that difference of moments exerted by the port-side and starboard asymmetrical loads does not exceed 4000 kg-m (arm is to be measured from the helicopter axis of symmetry to the cargo CG). Otherwise, helicopter controllability may be impaired.

Maximum tolerated CG positions:

- frontmost CG position - +360 mm in front of the main rotor axis;
- rearmost CG position - -220 mm aft of the main rotor axis when the helicopter is fully fuelled (6315 kg), but carries no payload;
- rearmost CG position - -200 mm aft of the main rotor axis for different variants of helicopter loading.

Fig.8 shows the reference frame suitable for computing CG positions.

WEIGHT OF HELICOPTER MAIN UNITS

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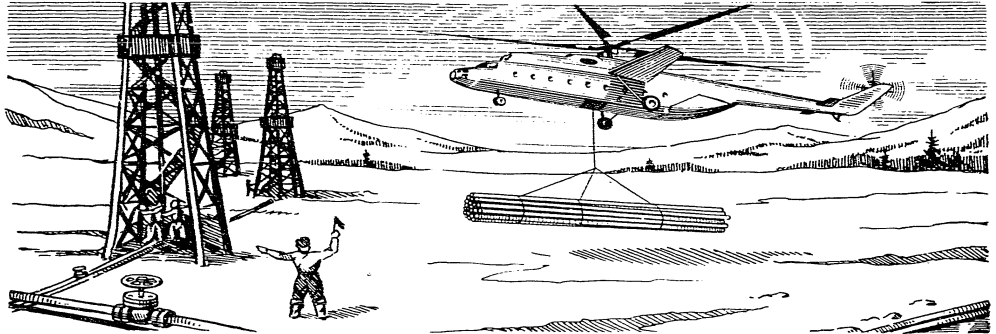
No.	Description	Quantity	Weight, kg
1	Fuselage nose portion	1	366
2	Fuselage middle portion	1	3400
3	Tail boom	1	360
4	Pylon	1	256
5	Wing panel	2	252x2
6	Centre plane beam	1	153
7	Stabilizer	1	39
8	L.G. main leg	2	520x2
9	L.G. nose leg	1	200
10	Engine II-25B (dry)	2	1275x2
11	Main gear box P-7	1	3237
12	Intermediate gear box	1	104
13	Tail gear box	1	287
14	Main rotor hub	1	3148
15	Swashplate	1	696
16	Main rotor blade	5	696x5
17	Tail rotor in assembly with hub	1	570
18	Fan assembly (with heat exchangers)	1	239
19	External tank with attachment fittings	2	129.5x2

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Chapter IV

BASIC STRUCTURAL ELEMENTS

The Mx-6 helicopter is a single-main rotor machine equipped with two turbo-rotor engines A-25B. The helicopter is made up of the following basic units and systems:

- fuselage;
- wing;
- stabilizer;
- power plant;
- main rotor;
- tail rotor;
- transmission and fan assembly;
- controls;
- landing gear;
- hydraulic system;
- air supply system;
- sling system;
- electrical equipment;
- instruments;
- radio equipment;
- special equipment.

FUSELAGE

The helicopter fuselage is a streamlined riveted all-metal structure consisting of longitudinal stringer assembly, frames, and duralumin skin of various thickness.

The fuselage is made up of four basic parts: fuselage nose and middle portions, tail boom, and pylon.

The fuselage nose portion accommodates crew cabins and most of the helicopter equipment. It is divided by the partitions to form three cabins: navigator's cabin

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in the front section of the fuselage nose portion, pilots' cabin arranged behind the navigator's cabin, and radio-operator and flight engineer's cabin arranged in the rear of the fuselage nose portion. Passage-ways are provided between the crew members' stations.

The fuselage middle portion accommodates the cargo compartment with loading ramps. Arranged over the ceiling of the cargo compartment are engine compartment, gear box compartment, and fuel tank compartment.

The cargo compartment (Fig. 9) provides for accommodation of various kinds of machines, vehicles, and large-size loads. The floor of the cargo compartment is stressed. Arranged under the floor are containers of eight fuel tanks. The rest three fuel tanks are located in containers over the ceiling of the cargo compartment.

The cargo compartment is equipped with hydraulically-operated door panels and ramps designed for loading the cargo. When closed, the door panels form the rear contour of the fuselage. The starboard of the cargo compartment incorporates a door and nine windows, the port side, two doors, and seven windows. Besides, each door is provided with a window. The floor of the cargo compartment has a central hatch closed with doors.

The tail boom is a duralumin riveted structure consisting of frames, stringers, and duralumin skin. The tail boom is jointed to the fuselage (by means of fittings) along face frame No. 42. Accommodated inside the tail boom are transmission tail shaft, foot pedal control cables, and stabilizer attachment units.

The tail boom continuation is a pylon whose axis is at an angle of 47° to that of the tail boom. The lower portion of the pylon accommodates the intermediate gear box and its upper portion, the tail gear box whose shaft mounts the tail rotor.

The pylon consists of three main parts: fin beam, fixed rudder, and detachable fairing which may be removed to ensure access to the intermediate gear box and attachment unit of the tail bumper shock absorber.

The fin beam is made up of frames, stringers, slant spar, ribs, and duralumin skin. The spar mounts the attachment unit of the tail bumper shock absorber.

The riveted fixed rudder consists of ribs, longitudinal set of angle bars, intersecting bands, and skin. To reduce the load imposed on the tail rotor during maximum speed flight, the rib profiles are made asymmetrical. From the side of the tail rotor the fixed rudder is covered with duralumin sheet, and from the opposite side, with linen. The gills provided in the upper left portion of the rudder are designed for exhausting the air which cools the intermediate gear box. The fixed rudder is attached to the fin beam by screws and self-locking nuts.

The detachable fairing is made up of a duralumin structure and electron skin. The fairing is secured to the fin beam and fixed rudder by screws and self-locking nuts.

WING

The helicopter mounts a cantilever controllable wing which is fixed by means of the FMK-1 hydraulic mechanism in two positions:

- at all power ratings of flight at an incidence angle of $+14^\circ 15'$ relative to the datum line (the angle is specified for the port wing panel);
- in autorotation at an incidence angle of $+4^\circ 15'$. The incidence angle of the starboard wing panel is by $1^\circ 30'$ more than that of the port wing panel.

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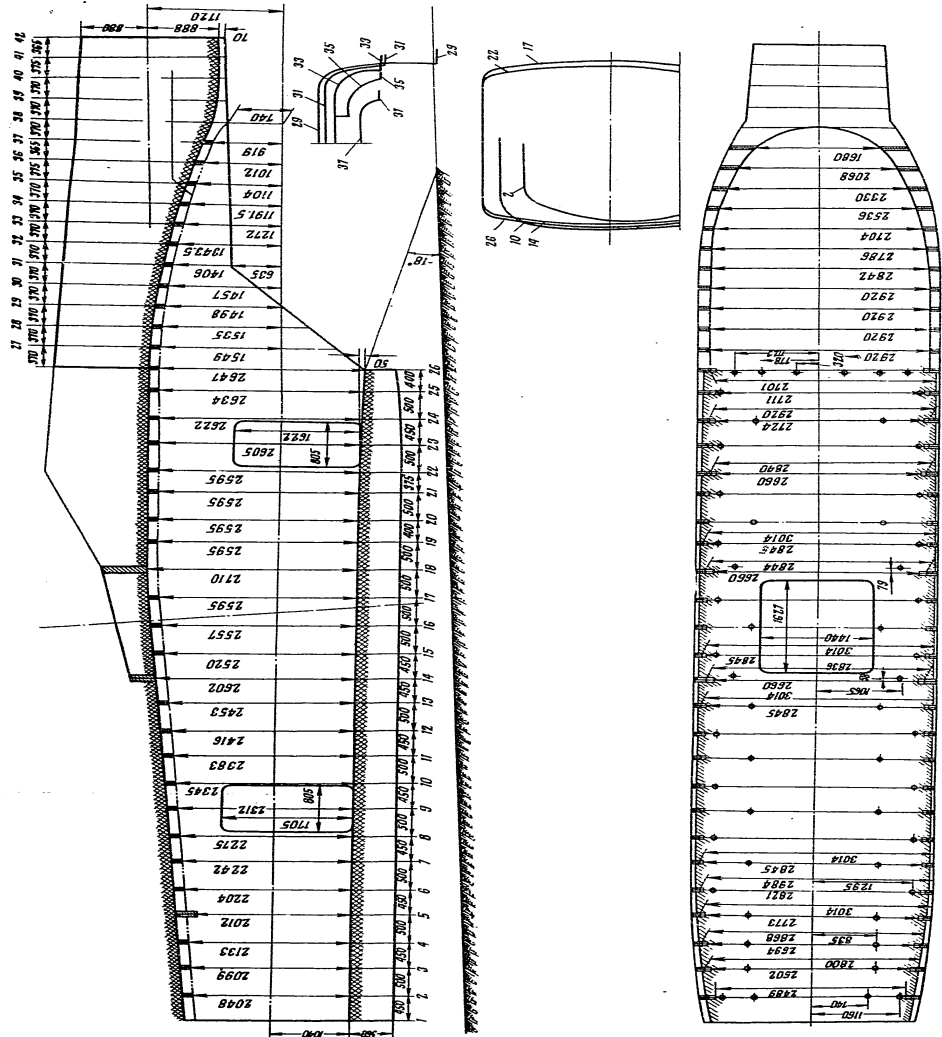


FIG.9. CARGO COMPARTMENT DIMENSIONS

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The wing is a riveted structure made up of the centre plane beam and starboard and port wing panels jointed to the beam. The wing panel consists of a strong box spar, leading and trailing portions, and wing tip. Except the strong box spar, the wing framework includes a set of ribs and stringers. The wing is covered with duralumin sheets of various thickness.

The box-section centre plane beam is riveted of thick duralumin sheets, the upper and lower webs of the beam being reinforced with stringers. The webs are jointed by longitudinal profiles and reinforced by blind lateral diaphragms.

The centre plane beam passes between frames Nos 18 and 19 of the fuselage and is hinged to two units arranged on frame No.18. Two mating attachment units are riveted to the front lower angle bars of the beam symmetrically with regard to the fuselage axis. The front right angle bar of the beam carries a unit for attachment of the operating rod of the FMK-1 hydraulic mechanism.

The streamlined wing-to-fuselage joint is ensured by fillets.

The wing section subjected to heating by exhaust gases is protected by a special shield mounted on angle bars possessing a low heat-conductive property and secured by bolts and anchor nuts. The clearance between the shield and wing skin provides for cooling both of them by the relative air stream.

STABILIZER

The helicopter incorporates a stabilizer intended for adding up to the helicopter controllability and stability. The stabilizer is made up of the port and starboard panels interconnected by a spar. Except the beam-type spar, the stabilizer framework includes duralumin ribs, diaphragms, and trailing edge stringer. The leading edge of the stabilizer is covered with duralumin sheets, and the trailing edge, with linen. The stabilizer is provided with two units for its attachment to the tail boom and with an attachment unit of the control rod.

POWER PLANT

The helicopter is equipped with two turbo-rotor engines D-25B mounted over the cargo compartment and arranged symmetrically relative to the helicopter longitudinal axis but tilted through 5° downwards with regard to the fuselage axis. Each engine is secured to the fuselage by brackets and by means of adjustable struts furnished with rubber pads. Both engines operate independently from each other which makes it possible to fly on one engine, if necessary.

The D-25B engine has a two-stage free turbine which is engaged with the main gear box through a transmission shaft and does not have a mechanical connection with the compressor turbine. Since the free turbines and compressor turbines are not connected mechanically, there is no need for a clutch.

The free turbine makes it possible to set the main rotor rpm within the required range irrespective of the engine rating which provides for optimum specific consumption of fuel.

The exhaust gases of the engines are withdrawn into the atmosphere through the welded exhaust pipes provided with internal ducts. Running through the duct is the engine transmission which connects the shaft of the engine free turbine with the main gear box.

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From the outside the exhaust pipe is protected with a shroud. The profiles welded to the exhaust pipe shroud inside surface form spiral channels which guide the air flow for cooling the exhaust pipe. Mounted above and behind the engines, between the exhaust pipes is a fan assembly driven by the main gear box.

The helicopter fuel system consists of two lines.

The fuel is contained in 11 pipe-connected bag tanks which form 5 tank groups. Each group of tanks and the reserve fuel tank incorporate electrical fuel booster pumps which ensure fuel delivery and produce the required fuel pressure upstream of the engine pumps. The amount of fuel is measured by the fuel quantity gauge transmitters mounted in the tanks. To increase the range of flight, provision is made for installation of two external tanks secured to the fuselage sides by brackets and bracing tubes. From the external tanks the fuel flows by gravity to tank No.7

Given below are groups and capacity of fuel tanks:

Group I (tanks Nos 2, 3)	940 lit (470 lit in each tank)
Group II (tanks Nos 4, 5, 6)	1410 lit (470 lit in each tank)
Group III (tanks Nos 7, 8)	870 lit (435 lit in each tank)
Group IV (tanks Nos 9, 10)	2700 lit (1350 lit in each tank)
Group V (tank No.11)	1760 lit
Reserve fuel tank No.1	470 lit
Total capacity	8150 lit
Capacity of two external tanks	4500 lit (2250 lit in each tank).

The fuel is supplied to the engines automatically. Provision is made for manually cutting in and out any of the fuel pumps and thus for varying the succession of fuel consumption from the tanks.

The engine and main gear box compartments are equipped with the fire-fighting system which operates automatically on obtaining the signal from the fire detectors.

The helicopter power plant incorporates two oil systems:

- engine compressor section oil system made up of two tanks (each of 30-lit capacity), two oil coolers, and pipes;
- oil system of the main gear box, free turbines, and engine transmission. This system consists of two oil coolers with by-pass valves and oil pipes.

The engines, fan assembly, and main gear box are enclosed by a common cowl made up of air intakes, front compartment, fire bulkheads, fan assembly and gear box compartments, and fairing.

To protect the air intakes from ice formation their nose portions are provided with electrical heaters. The supports accommodated between the inner and outer skins of the air intakes mount the oil tanks of the engine compressor section.

To provide an access for servicing the engines, main gear box, and fan assembly, the right and left sides of the cowl incorporate hinged covers and hydraulically-operated retractable platforms.

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MAIN ROTOR

The main rotor consists of a hub and five blades. The blades are fully articulated which guarantees their flapping (angular motion about the flapping hinges), lagging (angular motion about the drag hinges), and feathering (angular motion about the feathering hinges). Blade flapping is kinematically connected with its feathering.

The blades are attached to the main rotor hub mounted on the main gear box shaft.

Blade oscillations in the main rotor plane are suppressed by hydraulic dampers mounted on the hub.

The main rotor hub is provided with a "flapping compensator" which reduces blade angle during its flapping motion, thereby increasing the blade motion stability and improving the helicopter performance characteristics.

The main rotor blade is an all-metal structure with a honeycomb filler in the blade tail portions. The basic stressed element of the blade is a tubular steel spar attached to which (by special units) are 20 individual sections lacking rigid inter-connection. When the blade curves, its sections do not interact with each other but transfer the aerodynamic and inertia loads just on the blade spar.

The blades are of a rectangular planform with the chord of 1000 mm and built-in twist varying in accordance with linear law.

The blades have an electrical de-icing system.

TAIL ROTOR

Variable-pitch tail rotor, type AB-63E-X6B, is intended for counterbalancing the reactive torque of the main rotor and for ensuring helicopter yawing stability and control.

The tail rotor engages with the tail gear box shaft by means of involute splines.

The tail rotor is driven by the main gear box through the tail transmission.

The pitch of the tail rotor is controlled from the pilots' cabin by manipulating the foot control pedals.

The tail rotor is a pushing reversible rotor with four wooden trapezoidal blades protected by metal strips.

The blades are attached to the tail rotor hub with hinges which ensure blade flapping.

Electrical de-icing system prevents ice formation on the blades.

TRANSMISSION AND FAN ASSEMBLY

The helicopter transmission is intended for transmitting the power of the engine free turbines to the main and tail rotors, as well as to the fan assembly.

The transmission is made up of the main, intermediate and tail gear boxes, tail and pylon shafts, main rotor brake, and fan assembly drive.

The main gear box reduces the rpm and transmits the engine torque to the main rotor shaft, tail shaft, and fan assembly. The drive from the free turbines to the main gear box is effected through the free-wheel clutches. The free-wheel clutches are designed for disengaging the free turbines at autrotation and for disengaging one of the free turbines when flying on one engine. The main gear box incorporates also

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four drives for the hydraulic pumps, two drives for the de-icing system generators, two drives for the tachometer generators, and two reserve drives.

Mounted on the gear box housing near the tail shaft drive end is a main rotor brake with expanding blocks. The brake drum is connected to the flange of the tail shaft drive end. The main rotor brake is intended to brake the transmission during helicopter parking.

The main gear box and the engine free turbines possess a separate oil system. Two oil pumps mounted in the main gear box pump hot oil through two oil coolers. The total amount of oil contained in the main gear box and its oil system constitutes about 260 lit.

The tail shaft designed for transmitting the driving torque from the main gear box through the intermediate gear box to the tail gear box consists of eleven sections, nine sections mounted on eight supports being accommodated before the intermediate gear box and two sections mounted on one support being installed between the intermediate and tail gear boxes.

All the sections of the tail shaft are splined to each other which compensates for inaccurate installation of the supports and eliminates the effect of deformation caused by variations in temperature and stresses.

The intermediate gear box transfers the driving torque from the main gear box to the tail one. Two bevel gears with spiral teeth ensure the inclination of the tail shaft axis through an angle of 47° with due respect to the configuration of the pylon.

The intermediate gear box is provided with two oil systems: the main oil system employing forced oil feed and duplicating oil system which provides for oiling the bearings by splash lubrication method when the main oil system gets inoperative. The intermediate gear box contains 7 lit of oil.

The intermediate gear box is attached to the units on the pylon frame by means of four lugs mounted on the gear box case.

The tail gear box is intended to transmit the driving torque from the intermediate gear box to the tail rotor and to reduce the speed. It consists of two bevel gears with spiral teeth. The tail gear box accommodates the pitch control mechanism of the tail rotor. The tail gear box possesses a separate oil system consisting of the main oil system with forced oil feed and duplicating oil system employing splash lubrication. The tail gear box contains 26 lit of oil.

The fan assembly is designed to cool the following units: oil coolers of the engines and main gear box, D.C. and A.C. generators, air compressor, hydraulic pumps, engine exhaust pipes; it serves also to supply air into the ventilation system of the helicopter cargo compartment.

The fan assembly is driven by the cardan shaft engaged with the main gear box. The amount of air flowing through the fan assembly is controlled by means of a special mechanism which changes the setting angle of the inlet guide vanes. In case of fire, the vanes are rapidly closed by the hydraulic cylinder.

CONTROLS

The helicopter is controlled relative to three axes by varying the magnitude and direction of the main rotor thrust and changing the magnitude of the tail rotor thrust.

The lateral and longitudinal control is effected by the control stick manipulation. When the pilot deflects the control stick, the swashplate changes the tilt of the main rotor thrust resultant force.

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The jawing control is effected by applying the foot control pedals, thereby changing the collective pitch of the tail rotor and, consequently, changing the magnitude of the tail rotor thrust.

To produce the required gradient of forces on the control stick and foot control pedals, the spring-feel mechanisms are included into the control stick and foot pedal systems. The control stick is trimmed by cutting in the trim switch which energizes the MH-100M electric actuator. The trim switch is located on top of the control stick. In case of the control by foot pedals, the electric actuator is energized by cutting in the limit-switches and toe buttons arranged on the foot rests of the control pedals.

The change of main rotor thrust magnitude is obtained by manipulating the collective pitch-throttle control lever which varies the collective pitch of the main rotor and ratings of the engines. The displacement of the collective pitch-throttle control lever causes the respective change of the stabilizer setting angle.

Except the collective pitch-throttle control lever, the helicopter engines may separately be controlled by the throttle levers which provide for testing each engine without changing the collective pitch of the main rotor and ensure setting the required rating when flying on one operating engine.

The pilot checks the magnitude of the main rotor collective pitch and the spring-feel mechanism position against the indicators mounted on the instrument panel.

The helicopter is equipped with dual control basically of link-and-rod construction. The control is exercised separately by each pilot. The tail rotor and the stabilizer are controlled through the cables laid down in the fuselage tail portion and tail boom.

The helicopter control system involves two-chamber hydraulic boosters operating in one direction only (irreversible hydraulic boosters).

The helicopter is equipped with three-channel autopilot, type AH-31B, which stabilizes the helicopter with reference to the angular velocity, pitch, roll, and yaw. The autopilot operates only when the hydraulic boosters are fed from the main system. If the main hydraulic system fails, the autopilot is automatically disconnected and the hydraulic boosters will be fed from the duplicating hydraulic system and shifted under the manual control.

LANDING GEAR

The helicopter has a non-retractable three-wheel landing gear and tail bumper with oleo-pneumatic shock struts. The landing gear permits the helicopter to take off and land vertically or normally.

The nose strut of the landing gear arranged along the helicopter axis of symmetry is attached to the units on frame No.1 of the fuselage middle portion. The strut mounts two wheels (wheel pair), 720x310 mm in size, without brakes; the wheels are arranged on one axle and may be castored during taxiing. The initial pressure in the wheel tube amounts to 6 kg/cm².

The main struts of the landing gear are of the tripod design. Each strut is made up of the half-axle, brace strut, two-chamber shock absorber, all of them being attached to the units on frames Nos 18 and 22 of the fuselage middle portion. The half-axes of the landing gear main struts mount brake wheels, 1325x480 mm in size, with arc tyres. The initial pressure in the wheel tube amounts to 7 kg/cm². The brake system is of the one-sided chamber-type design. Braking is effected by means of the pneumatic system.

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The shock absorbing system of the landing gear main legs incorporates the spring damper of ground vibrations with pipes communicating the damper with the chambers of the high-pressure shock absorbers.

The tail bumper consisting of the shock absorber, two brace struts, and shoe is provided to guard the tail rotor and tail boom against damage in normal landing.

The shock absorbers and damper are filled with 64 lit of fluid AMP-10 distributed as follows:

in two high-pressure shock absorbers	40 lit
in two low-pressure shock absorbers	9.6 lit
in nose strut shock absorber	6 lit
in tail bumper shock absorber	2.25 lit
in spring damper and hydraulic-transfer pipes	6 lit.
The initial pressure of commercial nitrogen in the shock absorbers amounts to:	
in high-pressure shock absorber of landing gear main legs	48 kg/cm ²
in low-pressure shock absorber of landing gear main legs	14 kg/cm ²
in landing gear nose leg shock absorber	27 kg/cm ²
in tail bumper shock absorber	60 kg/cm ²

HYDRAULIC SYSTEM

The hydraulic system of the helicopter includes the main, duplicating, and auxiliary hydraulic systems.

The main and duplicating hydraulic systems are intended for supplying the hydraulic fluid to all the hydraulic boosters installed in the helicopter control system and to the PMK-1 wing control hydraulic mechanism.

The auxiliary hydraulic system is provided to ensure: operation of windshield wipers, unhooking of the collective pitch-throttle control lever, adjustment of pilots' seats in height and tilt of the backrest, operation of the fan inlet guide vanes actuating cylinder and sling lock actuating cylinder. Besides, when the helicopter is on the ground, the auxiliary hydraulic system provides for opening and closing of the cargo compartment door panels along with extension and retraction of the loading ramps and engine cowling platforms.

The hydraulic system employs antifreeze fluid AMP-10 at a working pressure of 120 - 155 kg/cm². This fluid preserves its properties being exposed to the ambient temperature from +60° to -50°C.

The pumps of the main, auxiliary, and duplicating hydraulic systems are mounted on the drives of the main gear box which provides for normal operation of the hydraulic system when the engines fail and the helicopter performs an autorotation flight.

Most of the units of the main, auxiliary, and duplicating hydraulic systems together with the hydraulic accumulators and reservoirs form hydraulic assembly PB-1 mounted in the gear box compartment in the proximity of the pumps and hydraulic boosters. The hydraulic assembly incorporates two reservoirs designed for separate feeding of the main and duplicating hydraulic systems. The auxiliary hydraulic system receives the fluid from the upper portion of the duplicating hydraulic system reservoir.

The main hydraulic system has two hydraulic pumps HM2C and two hydraulic accumulators, while the auxiliary and duplicating hydraulic systems include one pump and one hydraulic accumulator each. Each system involves also pump unloading unit PA-77, coarse and fine filters, pressure gauge, electric valve, and other accessories.

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All the hydraulically-operated units of the control system may be actuated by the main or duplicating hydraulic system. The only exception is the autopilot which operates from the main hydraulic system.

The total quantity of fluid AMF-10 contained in the hydraulic system amounts to 100 lit (45 lit in each reservoir).

AIR SUPPLY SYSTEM

The helicopter air supply system is provided to ensure braking of the main landing gear wheels, operation of air blow-off band control mechanism, and changing the position of shutters in the heating and ventilating system pipes.

The air compressed to 50 kg/cm² is contained in upper chambers of the main landing gear shock struts which serve as air bottles. Charging of the air bottles is performed by means of compressor AK-50T mounted on the port engine.

SLING SYSTEM

The helicopter is equipped with a sling system for external attachment of cargo. The sling lock with the actuating cylinder is mounted on four brace struts in the helicopter cargo compartment over the central hatch. Guards are mounted on the cargo compartment floor around the central hatch. The ring provided in the bottom portion of the fuselage does not allow the cable to touch the central hatch sides.

When attaching the cargo to the hook of the sling system and when releasing the cargo, the helicopter may hover or sit on the ground near the cargo. The cargo is attached by slings. For suspension of the cargo, use is made of the JMF-3 winch installed in the front portion of the cargo compartment beneath the threshold of the crew cabin.

When it is necessary, the cargo may be released in flight by depressing the electric button on the left collective pitch-throttle control lever or the electric button on the left control stick. For manual release of the cargo, the hydraulic valve handle should be displaced to the extreme lower position and the emergency release handle mounted on the sling lock should be shifted down.

The JMF-3 winch is employed also for loading and unloading the vehicles and cargo with the use of the ramps when the helicopter is on the ground.

ELECTRICAL AND RADIO EQUIPMENT, INSTRUMENTS, AND SPECIAL EQUIPMENT

The navigational, electrical, and radio equipment mounted on the helicopter enables it to perform flights in adverse weather conditions at any time of the day and night.

ELECTRICAL EQUIPMENT

The helicopter electrical equipment is provided to ensure operation of the flight and navigation instruments, power plant control instruments, radio sets, signalling devices, lighting and engine starting systems, de-icing system, electric mechanisms, electric valves, and other accessories.

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The helicopter power consumers are supplied with the D.C. voltage of 28.5 V $\pm$ 10% or with the A.C. voltage of 400 c.p.s.

The D.C. power is obtained from two starter-generators, type CTF-12TM, and two storage batteries, type 12CAM-55, accommodated in four containers, each storage battery consisting of two halves.

External power sources are connected through the receptacles mounted on the fuselage side.

The helicopter D.C. system is made up of the main and emergency circuits, and storage battery circuit. The consumers may obtain power from the following bus-bars:

1. Normal power supply bus-bar (connected to the circuits of the port and starboard generators).
2. Double power supply bus-bar connected to the circuit of the port or starboard generator.

3. Bus-bars supplying power from the storage batteries to the instruments.

The A.C. power is produced by two three-phase current generators CPC-90/360. Each generator yields power of 90 kVA with line voltage of 360 V.

The navigation instruments and radio equipment are fed with the A.C. current of 400 c.p.s. yielded by inverters IO-1500, IT-500H, and HAP-14H.

The D.C. and A.C. power sources are controlled by switches mounted on the instrument panel of the flight engineer and on the upper electrical panel of the pilots.

INSTRUMENTS

Instruments are divided mainly into flight and navigation instruments and instruments controlling the operation of the engines, transmission, and control system. The instrument indicators are arranged on the instrument panels of the pilots, navigator, and flight engineer.

RADIO EQUIPMENT

The radio equipment which is provided to ensure helicopter communication with ground and air-borne radio stations includes communication radio set 1-PCB-70 complete with the VC-9 receiver and command radio set PCMV-4H.

The radio-navigational equipment includes automatic radio compass APK-5, marker receiver WPH-56, and radio altimeter PR-2.

The crew members of the helicopter communicate with each other through the CTV-7 intercommunication system.

CPO Aircraft Transponder

The CPO aircraft transponder is an autonomous IFF system of meter wave band; it is intended to receive interrogation signals and to automatically send coded reply signals at the same frequency.

The CPO transponder installed on the helicopter is designed for operation with the aircraft, naval, and ground interrogator-responders. The CPO transponder permits the interrogating station to identify the helicopter and to determine distance to the interrogated helicopter.

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In flight the transponder operates automatically and needs no adjustment or maintenance. It is supplied with power from the helicopter D.C. mains of 27 V $\pm$ 10%. The consumed power does not exceed 155 W. The transponder weight equals 15 kg.

In case of helicopter failure or accident, the pilot may send distress signals. To this end, he should place the DISTRESS (СВЯЗЬ) switch on the code panel at the ON (ВКЛ.) position.

The complete set of the transponder includes:

1. Shock-mounted transceiver.
2. Code panel.
3. Antenna.
4. Antenna r-f cable.

5. Shielded bunched conductor connecting the transceiver with the code panel, two wires being branched to connect the helicopter mains.

The transceiver unit is accommodated under the floor at the right side of the pilots' cabin. The code panel is mounted on the pilots' upper panel. The antenna is arranged between frames Nos 7 and 8 on the lower skin of the fuselage nose portion slightly to the left from the helicopter axis of symmetry.

SPECIAL EQUIPMENT

The special equipment of the helicopter includes oxygen equipment, de-icing system, heating and ventilation, cargo handling and attachment equipment, and quick-detachable seats.

The oxygen equipment is provided to ensure normal work of the helicopter crew at high altitudes. The helicopter is equipped with five sets of KM-48 oxygen regulators intended for crew members.

The de-icing system is designed to ensure helicopter flying at icing conditions. The de-icers are mounted on the blades of the main and tail rotors, in the air intake nose portions, on two extreme glass panels of the pilots' cabin hood, and on the front and upper glass panels of the navigator's cabin.

All the de-icers are of the electrical type and are fed with power from the GTC-90/360 A.C. generators. The de-icers on the blades of the main and tail rotors are connected intermittently, while those of the air intakes and cabin glasses operate continuously.

The pilot is warned of ice formation by the ice-warning indicator which actuates when the pressure pick-up unit gets clogged.

Cabin heating and ventilation. The helicopter incorporates an air system for heating and ventilating the crew cabins and cargo compartment.

The cabin heating system is of the two-circuit type. It employs the hot air delivered from the shrouds of the engine exhaust pipes. When the hot air passes through the heat-exchangers, it heats the cold air supplied by the fan assembly from the cargo compartment or from the outside. The heated air flows across the air supply lines to heat the cabins. The amount of heated air supplied to the cabins may be controlled by handles situated within the reach of each crew member.

Two middle front glass panels of the pilots' cabin are heated by the warm air supplied through the air supply lines from the cabin heating system.

The air supply lines of the heating system may be employed for ventilating the helicopter cabins. Besides, the cargo compartment is ventilated by the air delivered by the fan assembly. The air flows through special ducts into the ventilation assemblies mounted on both sides of the fuselage.

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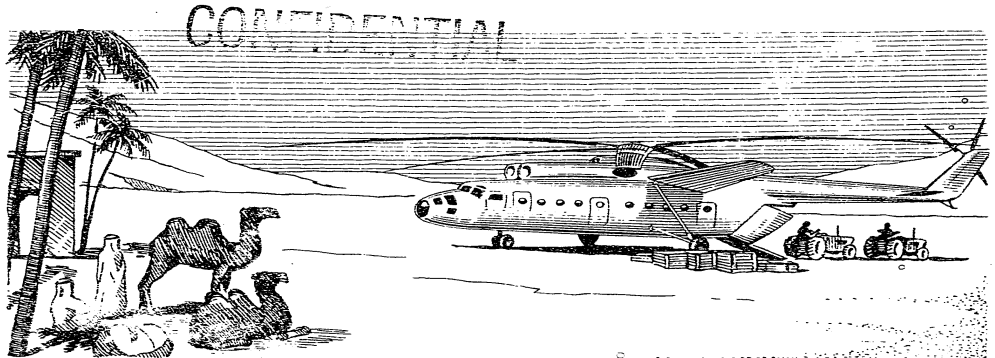
Cargo Handling and Attachment Equipment. To load and secure cargo and vehicles carried in the cargo compartment, the helicopter is furnished with special cargo handling and attachment equipment which includes cables, nets for small-size cargo, flooring for caterpillar vehicles, chocks, and other appliances.

Passenger Transportation. When it is necessary to airlift passengers, quick-detachable seats for 65 persons may be mounted in the cargo compartment. Four seats and four three-seat chairs are accommodated on the starboard, six single-seats and three three-seat chairs, on the port side, and three detachable six-seat and two eight-seat chairs, along the helicopter axis of symmetry. The seats are fixed in the collapsed position by springs.

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Chapter V

HELICOPTER PERFORMANCE CHARACTERISTICSSPEEDS, ALTITUDES, AND TIME OF CLIMBING

Given below are the maximum level and vertical speeds, time of climbing, and maximum altitudes of flight.

Permissible maximum level speeds, km/hr:

	T.A.S.	I.A.S. (as measured by means of left Pitot-static tube)
1. With normal all-up weight:		
at sea level	288	300
at H = 1000 m	300	300
at H = 2000 m	287	270
at H = 3000 m	270	240
at H = 4000 m	232	190
at H = 4500 m	212	165
2. In overload variant:		
at sea level	244	250
at H = 1000 m	256	250
at H = 2000 m	240	220
at H = 3000 m	200	190

Minimum level speeds, km/hr:

	T.A.S.	I.A.S.
at sea level	0	0
at H = 500 m	94	80
at H = 1000 m	96	80
at H = 2000 m	102	80
at H = 3000 m	138	110

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at H = 4000 m	145	110
at H = 4500 m	150	110

Maximum vertical speeds, m/sec:

at sea level	$V_y = 7.5$
at H = 1000 m	$V_y = 8.5$
at H = 3000 m	$V_y = 4.5$
at H = 4500 m	$V_y = 0.5$

Time of climbing, min:

H = 1000 m	t = 2
H = 3000 m	t = 7
H = 4500 m	t = 19.5

Maximum altitude of flight:

with normal all-up weight
in overload variant

$H_{max} = 4500$ m
 $H_{max} = 3000$ m

The maximum level speeds are plotted in Fig.10.

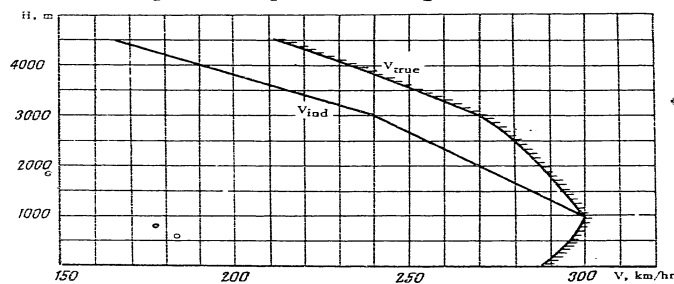


FIG.10. MAXIMUM LEVEL SPEEDS

The minimum indicated level airspeed of the Mx-6 helicopter ranges within 80 to 110 km/hr (Fig.11). At lower speeds the helicopter starts excessively vibrating. When the helicopter takes off and lands normally (as an aircraft), vibration at low speeds is not observed.

When flying at an altitude up to 10 m over the ground irrespective of its sea level position, the specified limitations in the minimum speeds are not to be observed.

The maximum vertical speed of climbing at normal rating amounts to $V_y = 7 - 8.5$ m/sec up to an altitude of 2000 m (Fig.12).

The speed for best climb from H = 0 to H = 3000 m equals 140 km/hr. At higher altitudes this speed becomes lower and at H = 4500 m the speed for best climb comprises only 120 km/hr.

Time of climbing of the helicopter with normal all-up weight is given in Fig.13.

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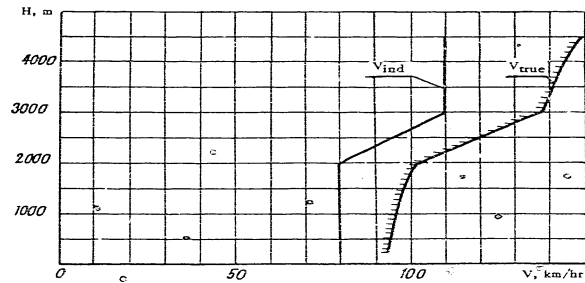


FIG. 11. MINIMUM LEVEL SPEED

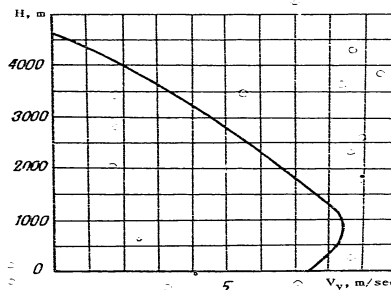


FIG. 12. MAXIMUM VERTICAL SPEED OF CLIMBING

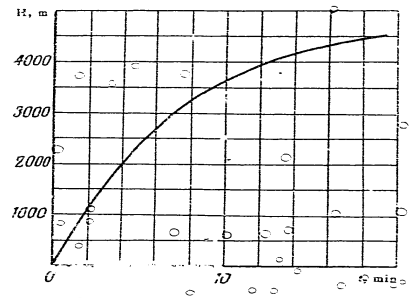


FIG. 13. TIME OF CLIMBING

The data of the main rotor rpm in percentage of the free turbine rpm (100% as measured by the tachometer corresponding to 10,000 rpm of the free turbine) are given in Table 3.

Table 3

H, m	Main rotor rpm, % (as measured by tachometer)			
	minimum tolerated	minimum recommended	maximum recommended	maximum tolerated
at sea level	78	79 + 1	83	87, not over 5 min
1000	78	79 + 1	83	87, not over 5 min
2000	80	81 + 1	83	87, not over 5 min
3000	82	83 + 1	85	87, not over 60 min
4000	84	85 + 1	87	87, not over 60 min
4500	85	85 + 1	87	87, not over 60 min

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With the main rotor autorotating, steady gliding is performed at speeds $V_{ind} = 140 - 190$ km/hr.

At heights below $H = 1500 - 2000$ m gliding is performed with the lowered collective pitch-throttle control lever. In this case the tolerated rpm of the main rotor comprise:

with normal flying weight - $n = 78 - 83\%$;
with decreased flying weight - $n = 70 - 80\%$.

At heights over $H = 1500 - 2000$ m the pilot should maintain the main rotor rpm within the specified limits (See Table 3) by selecting the pitch angle of the main rotor blades.

At autorotation the wing should be fixed at an angle of $\sim 5^\circ$ to reduce the actual incidence angles of the wing which increase during helicopter descent. When gliding at autorotation with the wing incidence angle of $\sim 15^\circ$, air stream stalling will be observed. However, the flying tests have proved that this phenomenon has no pronounced effect on the helicopter behaviour.

The vertical speed of descent of the helicopter with normal all-up weight at autorotation flight equals $10 - 12$ m/sec. The calibration chart of the speed indicator is shown in Fig. 14.

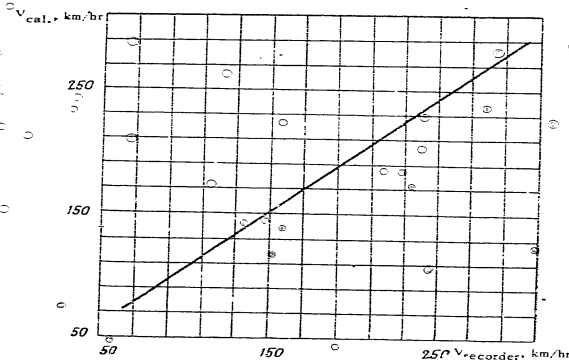


FIG. 14. SPEED INDICATOR CALIBRATION

RANGE AND ENDURANCE OF FLIGHT

The values of fuel consumption per kilometre and per hour depending upon the level speed (indicated speed) at the height of $H = 2000$ m for the helicopter with the normal all-up weight are given in Fig. 15.

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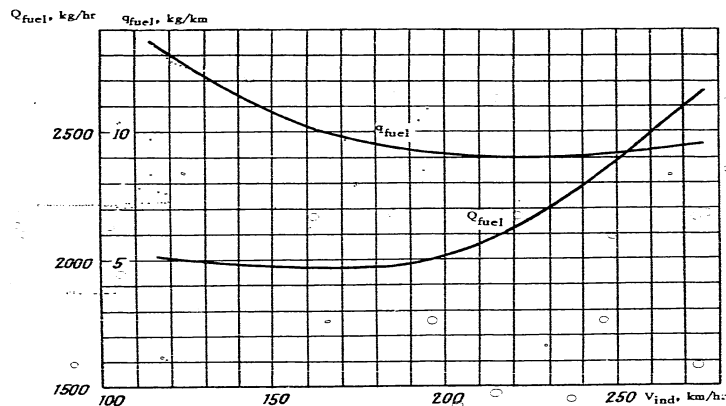


FIG. 15. VALUES OF FUEL CONSUMPTION PER KM AND PER HOUR

At the height of 2000 m the values of minimum fuel consumption per kilometre and per hour comprise:

$Q_{fuel\ min} = 9.1\ kg/km$ at $V_{ind} = 250\ km/hr$

$Q_{fuel\ min} = 1970\ kg/hr$ at $V_{ind} = 160 - 180\ km/hr$.

When determining the helicopter range and endurance of flight, allowance should be made for fuel consumption for starting and taxiing (120 kg), hovering and climbing to an altitude of 2000 m (350 kg), gliding and landing (225 kg). The unusable fuel quantity equals 30 kg. The climbing and descent path equals 31 km covered for 13 min.

The helicopter range and endurance (with 5% unusable fuel) with normal all-up weight and normal fuel quantity of 6315 kg (TC-1 fuel with specific weight of 0.775 at 20°C) at an altitude of $H = 2000\ m$ are as follows:

range of flight $L = 638\ km$ at cruising speed $V_{ind} = 250\ km/hr$;

endurance of flight $t = 2\ hr\ 50\ min$ at economical speed $V_{ind} = 160 - 180\ km/hr$.

Range of flight at $H = 3000\ m$ is the same as at $H = 2000\ m$.

In ferry variant with external fuel tanks with normal all-up weight and total fuel quantity of 9805 kg, the range of flight equals 1040 km at $V_{cruising} = 250\ km/hr$.

HELICOPTER CONTROLLABILITY

The helicopter stability and control characteristics as determined in the test flights prove that for the Mx-6 helicopter:

- the range of control stick and foot control pedals displacement provides for establishment of main states of the controlled flight and transition states through whole range of speeds and at all the operational CG positions. The margins of the roll, pitch, and yawing control are sufficient;

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- in straight-and-level flight at speeds more than $V_{ind} = 150 - 160$ km/hr the longitudinal displacements of the control stick are directly depend upon the speed of flight, i.e. to increase the speed of flight, the pilot should move the control stick forward

During climbing and autorotation, angle α varies directly with V_{ind} ;

- in cruising straight-and-level flight, the non-linearity, introduced into the law of kinematic connection of the control stick longitudinal and lateral displacements with tilt of the swashplate ring and introduced into the law of connection of the foot control pedal displacements with the blade angles of the tail rotor, ensures approximately neutral position of the control stick and foot control pedals;

- variations of forces on the control stick and foot control pedals depending upon the speed of flight correspond to the law of α , η , and Φ_{tail} change depending upon V_{ind} . At the level speed of $V > 120$ km/hr a larger forward control stick pressure will be required from the pilot to increase the speed;

- through the whole range of the tolerated speeds of flight and at all the operational CG positions the spring-feel mechanisms ensure complete trimming of the control stick and foot control pedals.

The helicopter displays perfect stability and control characteristics in all main states of flight.

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Chapter VI

HELICOPTER AERODYNAMIC CHARACTERISTICS

AERODYNAMIC CHARACTERISTICS OF MAIN ROTOR BLADE PROFILES

The following profiles are employed in the main rotor blades:

- at section from $\bar{r} = 0.217$ to $\bar{r} = 0.869$ - NACA-230M profile,
- at section from $\bar{r} = 0.869$ to $\bar{r} = 0.903$ - transition profile,
- at section from $\bar{r} = 0.903$ to $\bar{r} = 1.0$ - HAFM high-speed profile.

The main rotor blade has a rectangular planform with chord $b = 1.0$ m.

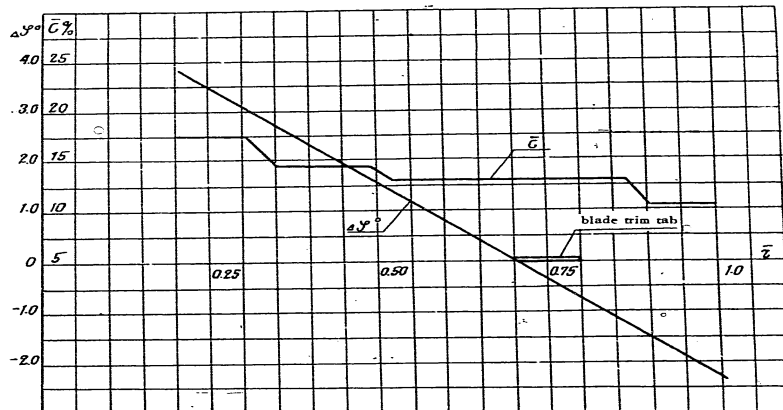


FIG.16. BUILT-IN TWIST AND THICKNESS-TO-CHORD RATIO OF MAIN ROTOR BLADES

The blade thickness-to-chord ratios, angles of built-in twist, and position of blade trim tab are presented in Fig.16. The blade trim tab is a plate projected

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over trailing edge of the blade. It is arranged at sections Nos 13, 14, and 15. The span of the main rotor blade trim tab l_{tab} is 1.82 m, chord b_{tab} equals 0.075 m and thickness S_{tab} is 0.8 mm.

The NACA-230M profile is a modified version of the NACA-230 profile. It is created by deflecting upward the blade trailing edge camber for increasing the profile curvature and thus obtaining positive values of C_m .

The aerodynamic characteristics of the NACA-230M profile and HAFM high-speed profile were determined by the wind-tunnel experiments which included blowing actual section of the blade (NACA-230M profile) and model blade (HAFM profile). The respective graphs are plotted in Figs 17 - 22.

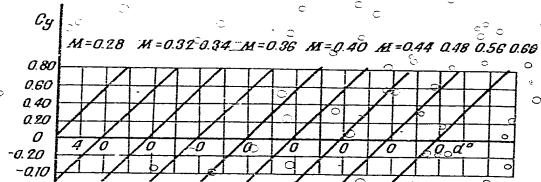


FIG.17. LIFT COEFFICIENT OF NACA-230M PROFILE
($\lambda = 3.68$), $R_e = (1.94 - 3.6) \cdot 10^6$

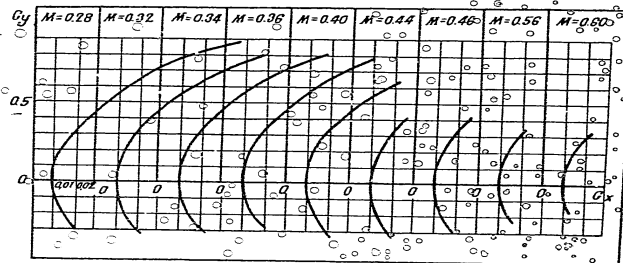


FIG.18. POLAR CURVE OF NACA-230M PROFILE ($\lambda = 3.68$)
 $R_e = (1.94 - 3.6) \cdot 10^6$

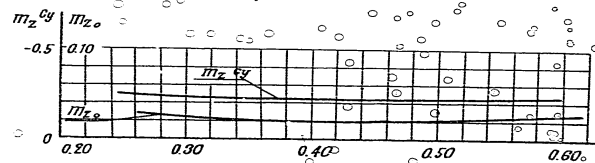


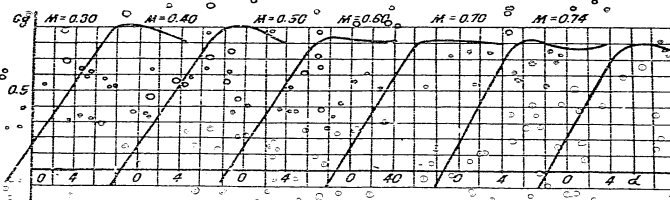
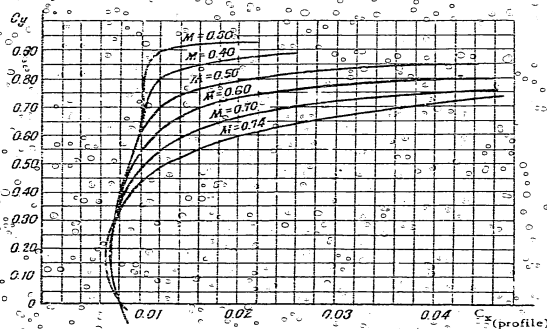
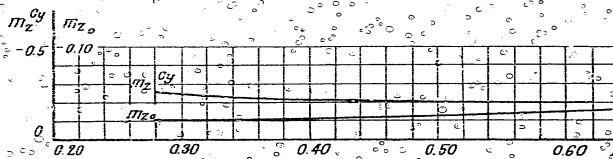
FIG.19. MOMENT CHARACTERISTICS M_z AND $M_{z_{cy}}$ OF NACA-230M PROFILE

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FIG. 20. LIFT COEFFICIENT OF IIA/H HIGH-SPEED PROFILE ($\lambda = 0$),
 $R_e = (1.16 - 2.5) \cdot 10^6$ FIG. 21. POLAR CURVE OF IIA/H HIGH-SPEED PROFILE
 $R_e = (1.16 - 2.5) \cdot 10^6$ FIG. 22. MOMENT CHARACTERISTICS m_z AND m_{z_0} OF
IIA/H HIGH-SPEED PROFILE

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WING AND FUSELAGE AERODYNAMIC CHARACTERISTICS

The aerodynamic characteristics of the fuselage with the wing and without it have been obtained by testing the model helicopter in the wind-tunnel.

The fuselage angles of attack and the incidence angles of the wing and stabilizer have been measured from the fuselage datum line. The coefficients of forces are related to the velocity head and to the wing area $S = 35 \text{ m}^2$ (together with the fuselage portion of the wing). The coefficients of moments are related to the velocity head, wing area, and main rotor radius $R = 17.5 \text{ m}$.

Shown in Fig.23 are the graphs of the lift coefficient of the fuselage with the wing and without it and given in Fig.24 are the polar curves of the fuselage with the wing and without it.

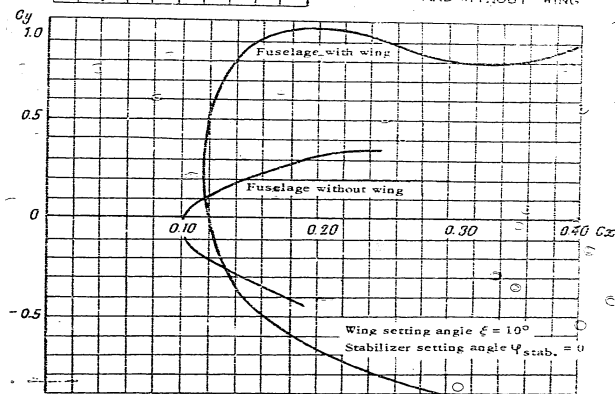
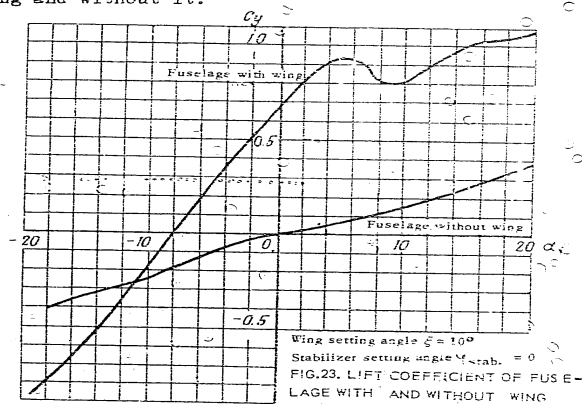


FIG.24. POLAR CURVES OF FUSELAGE WITH AND WITHOUT WING

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The wing polar curve obtained as the difference of the aerodynamic characteristics of the fuselage with the wing and those of the fuselage without the wing is presented in Fig. 25.

Plotted in Fig. 26 is the graph of the wing lift coefficient.

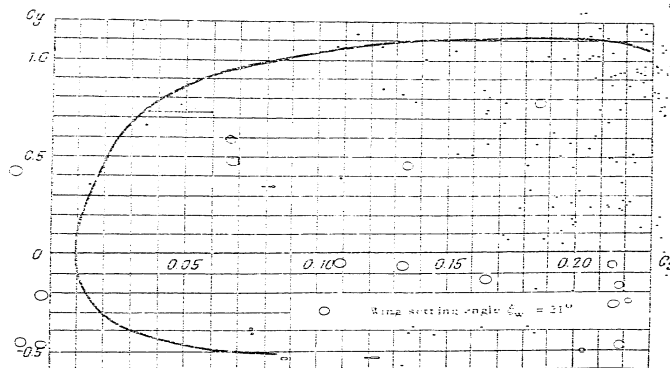


FIG. 25. WING POLAR CURVE

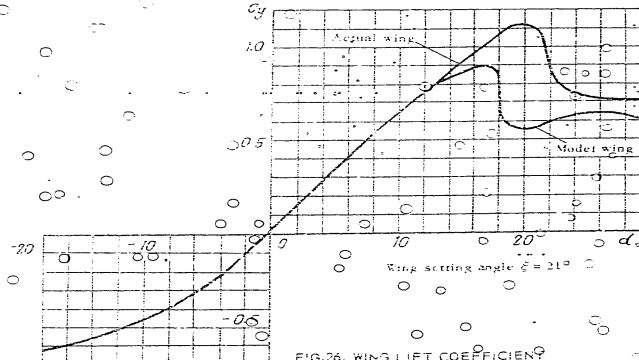


FIG. 26. WING LIFT COEFFICIENT

Wing geometrical characteristics:

Root chord $b_{\text{root}} = 2.667 \text{ m}$
 Tip chord $b_{\text{tip}} = 1.62 \text{ m}$
 Taper ratio $\eta = 1.65$
 Geometrical aspect ratio $\lambda = 6.69$
 Effective aspect ratio $\lambda_{\text{eff}} = 5.29$

The wing characteristics approximately equal the actual magnitudes due to large difference in R_e values, wing C_L max is increased by ~ 0.2 and α_w by $\sim 3^\circ$; wing C_D is not changed.

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Figs 27 - 30 show the stability characteristics of the model helicopter without the main and tail rotors.

The relationship between the longitudinal moment coefficient and fuselage angle of attack is presented in Fig. 27. This graph proves that the model helicopter maintains longitudinal static stability at all angles of attack that have been considered. The degree of the longitudinal stability at $\alpha = 0$ (which corresponds to cruising flight) comprises $m_x = -0.006$ (per 1°). At greater negative angles of attack the static stability diminishes.

The graph plotted in Fig. 28 shows the relationship between the yawing moment coefficient (yawing relative to semi-coupled OY axis) and angle of sideslip at the fuselage angle of attack $\alpha_f = -3.6^\circ$. The magnitude and variation of yawing moment coefficient m_y are practically the same when yawing is considered relative to the coupled OY axis. The graph shows that at the sideslip angles ranging from $\beta = -15^\circ$ to $+15^\circ$ the model helicopter displays static yawing stability. The increase of negative sideslip results in neutral stability characteristics while the increase of positive sideslip brings to lack of static yawing stability.

At small magnitudes of the sideslip angle the coefficient of static yawing stability equals $m_y^B = -0.007$ (per 1°). At positive angles of attack of the fuselage near to the angles arising in autorotation gliding the model helicopter displays static yawing instability within the specified range of the sideslip angles.

Fig. 29 presents the graph of the model helicopter roll moment coefficient (relative to the semi-coupled OX axis) depending upon the fuselage sideslip angle. The graph proves that the helicopter without the main and tail rotors displays some static roll stability. At $\beta = 0$ the degree of roll stability approximately amounts to the value of the order of $m_x^B = -0.001$ (per 1°) relative to coupled axis $m_x = 0$.

The graph plotted in Fig. 30 shows the relationship between the model helicopter side force coefficient and sideslip angle. This relationship is of linear character within the range of the considered angles.

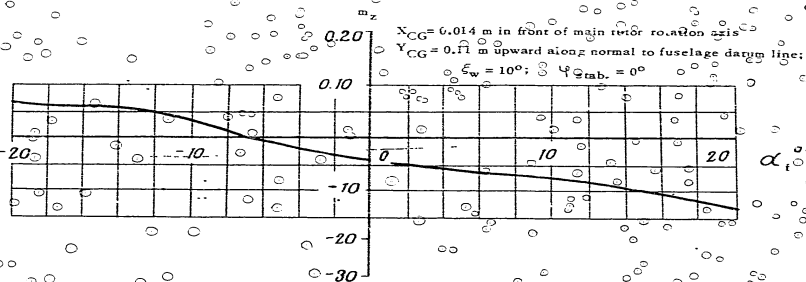


FIG. 27. MODEL HELICOPTER LONGITUDINAL MOMENT COEFFICIENT

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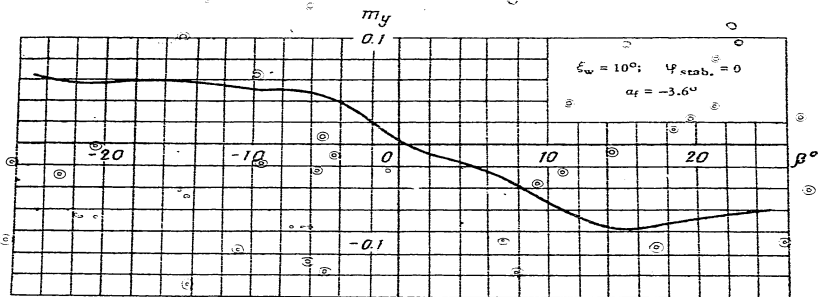


FIG.28. MODEL HELICOPTER YAW MOMENT COEFFICIENT

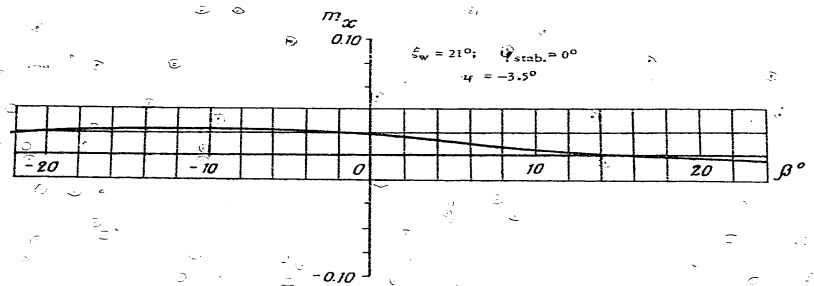


FIG.29. MODEL HELICOPTER ROLL MOMENT COEFFICIENT

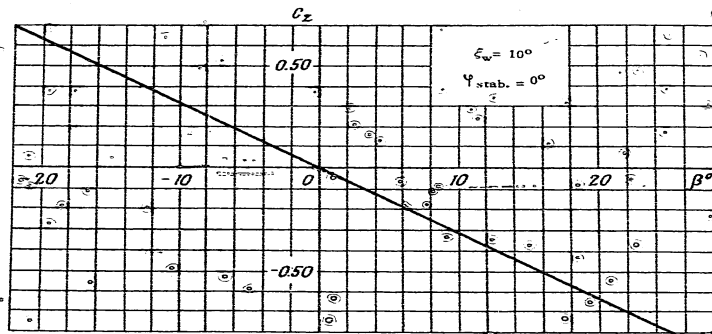


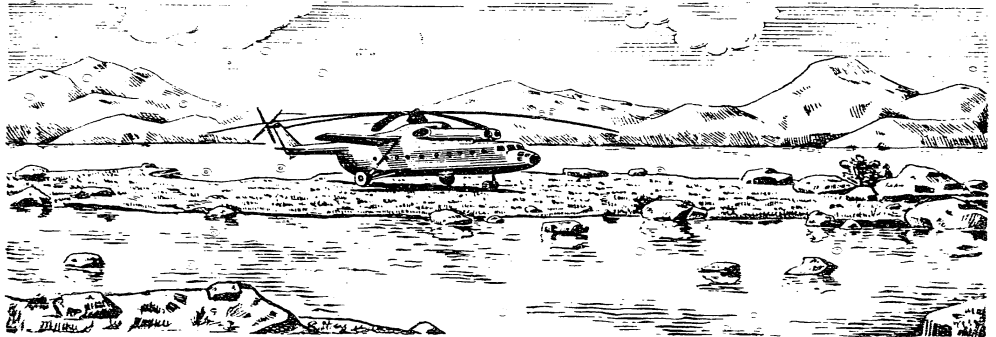
FIG.30. MODEL HELICOPTER SIDE FORCE COEFFICIENT

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Chapter VII

HELICOPTER LEVELLING

The helicopter is to be levelled during its assembly at the Manufacturing Plant and in the process of its maintenance to perform the following operations:

- jointing the fuselage nose portion with the fuselage middle portion;
- jointing the tail boom with the pylon and with the fuselage middle portion;
- mounting the main, intermediate and tail gear boxes, and installation of the tail shaft with its supports;
- mounting and adjustment of the controls;
- installation of the stabilizer and its supports;
- attachment of the wing;
- installation of the landing gear;
- installation of the fan assembly;
- attachment of the external tanks;
- mounting the Pitot-static tubes;
- application of artificial horizon setting notches on the instrument panel.

PLACING HELICOPTER ON JACKS

The helicopter is to be levelled in the hangar. When it is necessary, the helicopter may be levelled in field conditions provided there is no wind. In this case the main rotor blades should be removed.

Levelling is to be performed on a smooth ground with hard soil; when the soil is soft, wooden planks should be fitted under the jacks.

The helicopter to be levelled should have no fuel in the fuel system and no loads in the cargo compartment. The helicopter is to be mounted on four hydraulic jacks whose ball heads will fit into special spherical seats (sockets) provided on the fuselage: two seats are mounted in the lower portion of the landing gear brace strut attachment units on frame No.22 and the other two, near frame No.1 of the fuselage middle portion. The general view of the helicopter positioned on the hydraulic jacks is shown in Fig.31.

When lifting the helicopter, all four jacks should be uniformly operated.

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LEVELLING FUSELAGE MIDDLE PORTION

Each side of the fuselage middle portion has two reference points arranged on the datum line and made in the shape of rivets which are painted red. Drilled in each rivet is a central hole, dia. 0.8 - 1 mm. The front reference points are located near frame No.2 of the fuselage middle portion and the rear reference points, near frame No.25.

Draw steel strings, dia. 0.8 mm, through the rivet holes and pull on the strings in lateral direction to the cargo compartment.

Open the cargo compartment door panels, release the loading ramps, and position the level gauge approximately along the fuselage axis of symmetry at a distance of 5 - 6 m behind the ramps (Fig.32). Operate the hydraulic jacks to bring the fuselage middle portion to the horizontal position, i.e. to arrange both strings connecting the front and rear reference points in one horizontal plane. When the rest of the helicopter components (fuselage nose portion, tail boom, landing gear, etc.) are jointed to the fuselage middle portion, levelling is to be performed in the same way as specified above. The levelling data of the helicopter components and of the helicopter as a whole are to be checked in accordance with the levelling diagram (Fig.33) and the data specified in the drawings for installation and adjustment of the helicopter units and assemblies.

For checking the helicopter levelling data in the longitudinal direction, a string is to be pulled on along the axis of symmetry over the helicopter so that three plumb weights suspended from the string lie in one vertical plane, the first plumb weight being lowered on the reference point on the upper skin of the fuselage nose portion, the second plumb weight, on the main gear box axis, and the third plumb weight, on the tail boom axis of symmetry near frame No.18 (Fig.34).

Additional plumb weights may be suspended from the string at such sections where measurements in the vertical plane are to be taken.

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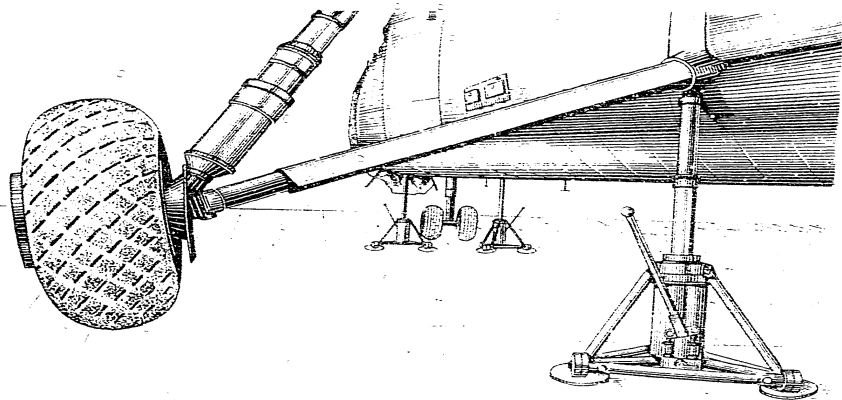


FIG.31. HELICOPTER POSITIONED ON HYDRAULIC JACKS

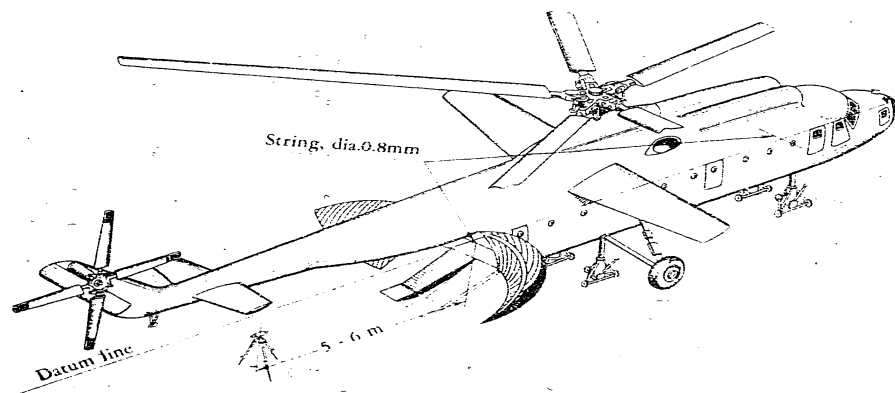
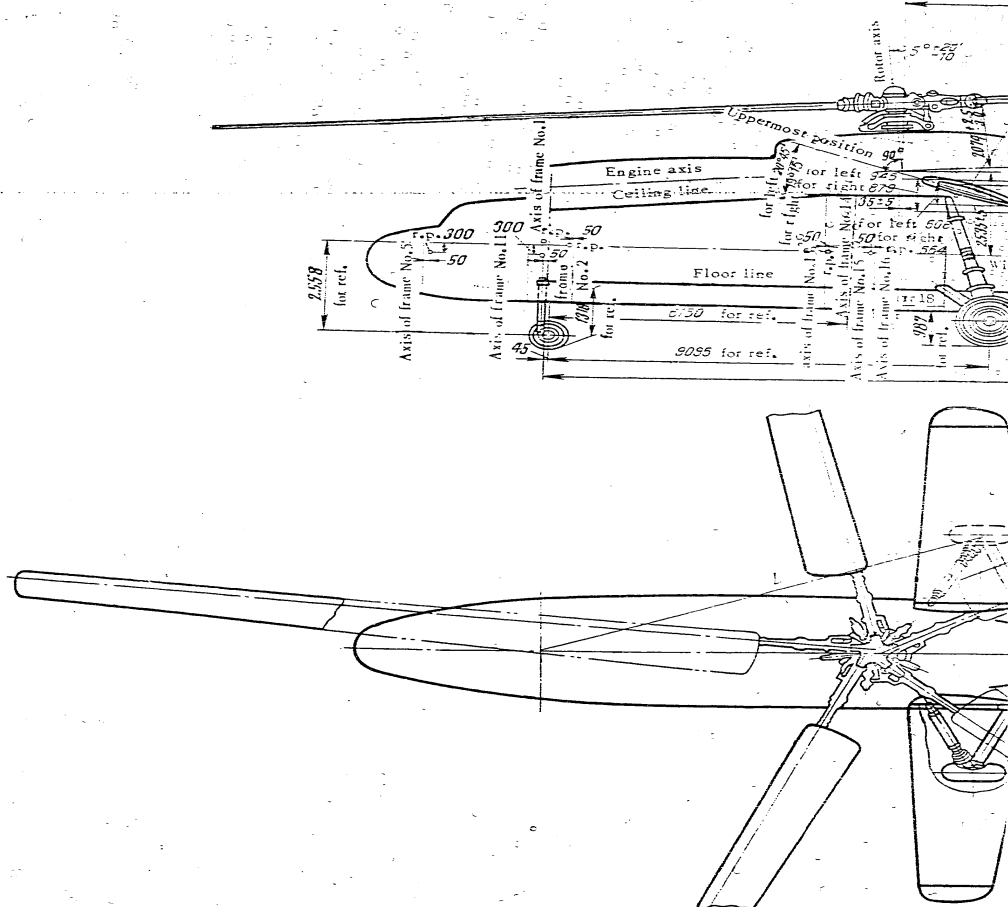


FIG.32. LOCATION OF HELICOPTER AND LEVEL GAUGE DURING LEVELLING

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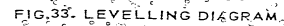
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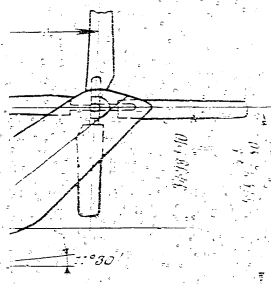
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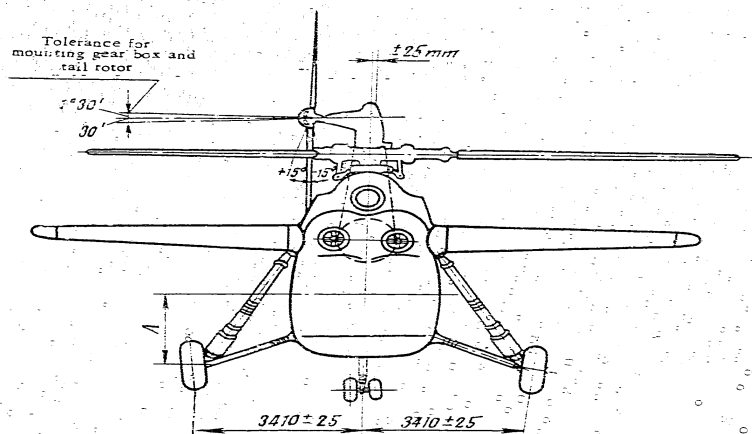
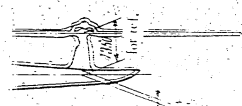


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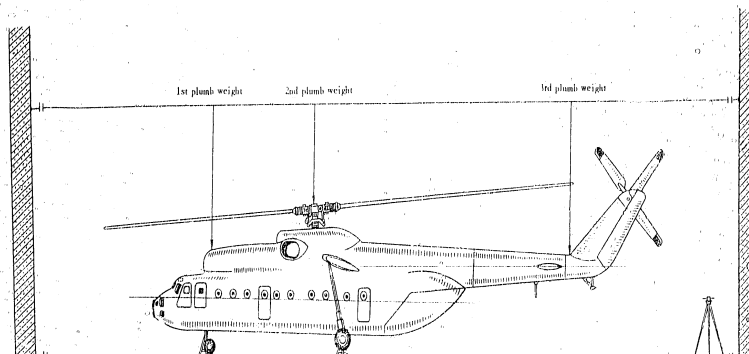


FIG. 34. DIAGRAM OF PLUMB WEIGHT ARRANGEMENT DURING HELICOPTER LEVELLING

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The Mi-6 helicopters may employ two types of main rotor blades: honeycomb-filled rectangular blades and trapezoidal blades of framework structure. These types of blades are fully interchangeable and any helicopter Mi-6 may use the set of rectangular blades or set of trapezoidal blades without any alterations.

Depending upon the type of the main rotor blades used, the helicopter possesses specific characteristics and performance data.

The present Supplement contains the performance data and characteristics of the Mi-6 helicopter with trapezoidal blades.

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BASIC PERFORMANCE DATA OF Mx-6 HELICOPTER
(with trapezoidal blades)

Maximum speed of level flight 250 km/hr
 Cruising speed at height of 2000 m 200 km/hr
 Minimum speed at sea level 0
 Maximum altitude of flight 4500 m
 Time of climbing (at normal rating):
 to altitude of 1000 m 2.7 min
 to altitude of 3000 m 9.1 min
 to altitude of 4500 m 22.5 min
 Range of flight at cruising speed with normal fuel amount
 or 6315 kg at height of 2000 m (with 5% unusable fuel) 600 km
 Range of flight at cruising speed at height of 2000 m with
 additional fuel in two external tanks. The total amount of
 fuel equals 9805 kg (with 5% unusable fuel) 977 km

Note: The indicated data are true for the helicopter with
 normal all-up weight.

Lifting capacity:
 in normal variant 6000 kg
 in overload variant 8000 kg
 in overload variant with decreased amount of
 fuel ($G_f = 2315$ kg) up to 12,000 kg
 on sling system up to 8000 kg
 Angle of stabilizer deflection (with reference to datum line):
 upward $+5^{\circ}30' \pm 30'$
 downward $-12^{\circ}30' \pm 30'$

SPEED, ALTITUDE, AND TIME OF CLIMBING

Given below are the speeds of level flight, maximum vertical speeds, time of
 climbing, and maximum altitudes of flight.

Maximum permissible speeds of level flight, km/hr:

1. With normal all-up weight:

	T.A.S.	I.A.S. (as given by port Pitot- static tube)
at sea level	260	265
at H = 500 m	263	260
at H = 1000 m	260	250

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at H = 2000 m	255	235
at H = 3000 m	220	190
at H = 4000 m	180	140
at H = 4500 m	160	120

2. in overload variant:

at sea level	160	100
at H = 1000 m	170	100
at H = 1500 m	175	100

Minimum permissible speeds of level flight, km/hr:

	T.A.S.	I.A.S.
at sea level	0	0
at H = 500 m	90	80
at H = 1000 m	92	80
at H = 1500 m	96	80
at H = 3000 m	112	90
at H = 4000 m	120	90
at H = 4500 m	122	90

Maximum vertical speeds, m/sec:

at sea level	$V_y = 6.4$
at H = 1000 m	$V_y = 6$
at H = 3000 m	$V_y = 6$
at H = 4500 m	$V_y = 0.5$

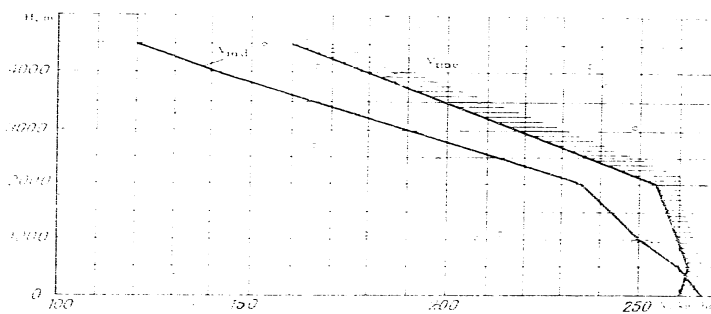
Time of climbing, min:

H = 1000 m	t = 2.7
H = 3000 m	t = 9.1
H = 4500 m	t = 22.5

Maximum altitude of flight:

with normal all-up weight	$H_{max} = 4500$ m
in overload variant	$H_{max} = 1500$ m

The maximum permissible speeds of level flight are presented in Fig. 1.



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The minimum indicated airspeed should be held within 80 to 90 km/hr (Fig.2). At lower speeds the helicopter is subjected to excessive vibrations. At normal take-off and landing the vibrations at lower speeds are not observed.

The chart of airspeed indicator calibration is shown in Fig.3.

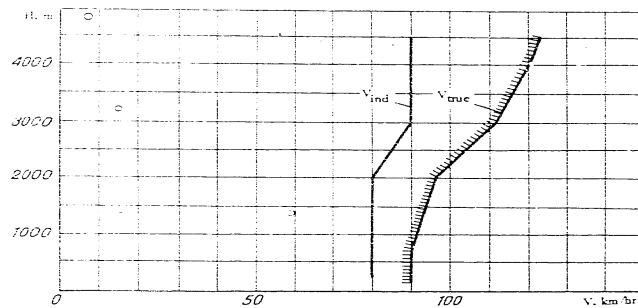


FIG.2. MINIMUM SPEEDS OF LEVEL FLIGHT

When flying at a height up to 10 m over the ground irrespective of its sea level position, the limitations of minimum speeds are not observed.

The maximum vertical speed of climbing at normal rating equals $V_y = 5.5 - 6.5$ m/sec up to a height of 2000 m (Fig.4).

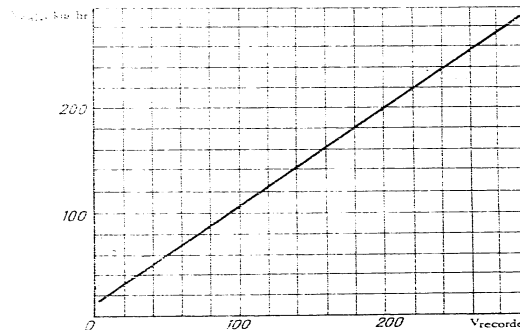


FIG. 3. CALIBRATION OF AIRSPEED INDICATOR

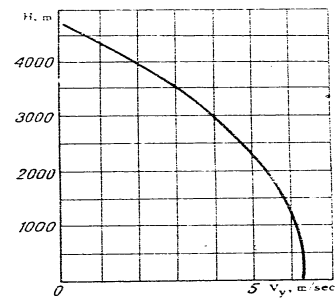


FIG. 4. MAXIMUM VERTICAL SPEEDS OF CLIMBING

The best speed for climbing from $H = 0$ to $H = 3000$ m amounts to 140 km/hr. With increase of height the speed becomes less and at $H = 4500$ m it equals 120 km/hr.

Time of climbing for the helicopter with normal all-up weight is shown in Fig.5.

The main rotor revolutions given in percentage of the free turbine rpm (100% read off the indicator correspond to 10,000 rpm of the free turbine) are presented in the Table below:

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Table

Altitude, m	Main rotor revolutions, % (as read off indicator)		
	minimum permissible	recommended	maximum permissible
at sea level	78	83±1	87, for not over 5 min
1000	78	83±1	87, for not over 5 min
2000	80	83±1	87, for not over 5 min
3000	82	83±1	87, for not over 60 min
4000	83	84±1	87, for not over 60 min
4500	84	85±1	87, for not over 60 min

The behaviour and control of the helicopter with trapezoidal blades in power gliding and at autorotation in no way differ from those of the helicopter with rectangular blades.

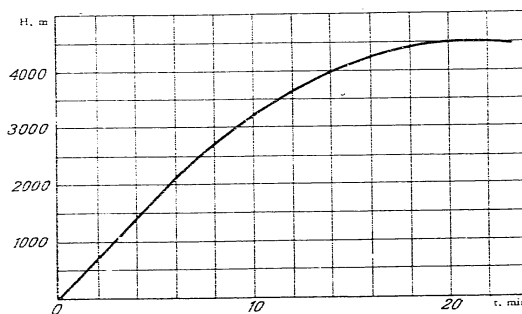


FIG. 5. TIME OF CLIMBING

RANGE AND ENDURANCE OF FLIGHT

The minimum fuel consumption per kilometre ($q_{\min}$) at $H = 2000$ m is as much as 9.9 kg/km at $V_{\text{ind}} = 200$ km/hr.

When determining the range of flight, allowance is made for consumption of fuel for starting and taxiing (120 kg), climbing to a height of 2000 m (350 kg), gliding and landing (225 kg). The unusable fuel equals 30 kg. The path covered during climbing and descent equals 31 km.

At an altitude of 2000 m the range of flight of the helicopter with normal all-up weight (with 5% unusable fuel) and normal fuel reserve of 6315 kg (fuel TC-1 with specific weight of 0.775 at 20°C) amounts to 600 km at cruising speed of $V_{\text{ind}} = 200$ km/hr.

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At an altitude of 3000 m the range of flight is the same as at an altitude of 2000 m.

The range of the ferry helicopter with fuel in the external tanks (total fuel reserve amounts to 9805 kg) equals 977 km at $V_{ind} = 200$ km/hr.

AERODYNAMIC CHARACTERISTICS OF MAIN ROTOR TRAPEZOIDAL BLADE PROFILES

Solidity of the main rotor with trapezoidal blades equals 0.0865.
The main rotor blade has a trapezoidal planform.

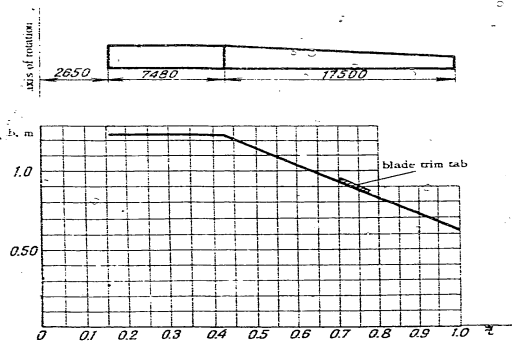


FIG. 6. BLADE PLANFORM AND VARIATION OF BLADE CHORD (b) IN RADIUS

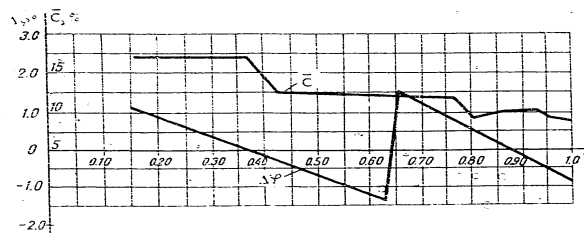


FIG. 7. VARIATION OF PROFILE THICKNESS-CHORD RATIO (C_t) AND BLADE BUILT-IN TWIST ($\Delta\phi$) IN RADIUS

Variation of chords, thickness-chord ratio of the blade profile, angles of blade built-in twist, and position of the blade trim tab are shown in Figs 6 and 7.

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S U P P L E M E N T No. 2

The helicopter may be equipped with machine gun mount HYB-1M.

In this case the empty weight of the helicopter includes the inert gas system and the armoured plates (with the total weight of 54 kg) attached to the navigator's door (according to drawing 50-7910-02), righthand from the navigator (according to drawing 50-7910-04), and to the pilots' cabin floor (according to drawings 50-7910-05/1-2 and 50-7910-06/1-2). The inert gas system and the armoured plates are arranged in accordance with the normal balance of the helicopter.

The rest of the armoured plates (weight $G = 94$ kg, arm from the main rotor axis equals $X = 8.950$ m) belong to the individual set and are mounted when necessary for the account of the payload.

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WEIGHT AND BALANCE DATA FOR LOADING VARIANTS OF
HELICOPTER EQUIPPED WITH HYB-1M MACHINE GUN MOUNT

Description of weights and balance	Variants		
	Transport	Transport with increased range	With cargo on sling system
Empty weight, kg	27130	27357	27355
C.G. position, m	-0.320	-0.316	-0.315
Total load, kg,	13103	12893	10145
including:			
Crew, kg	450	450	450
Oil, kg	280	280	280
Fuel (at $\gamma = 0.775$), kg	6315	9805	1357
Ammunition set, kg	34	34	34
Alcohol-glycerine mixture	24	24	24
Payload, kg,	6000	2300	8000
including:			
Cargo	5906	2206	7906
Armoured plates	94	94	94
Normal all-up weight, kg	40233	40250	37500
C.G. position, m	0.009	-0.083	-0.010
Additional load in over-			
load variant, kg	2000	2000	-
Overload all-up weight, kg	42233	42250	-
C.G. position, m	0.066	-0.022	-

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OPERATING AND PILOTING INSTRUCTIONS

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Chapter I

GENERAL

Successful flying on Mh-6 helicopter depends primarily on the rate of harmony that will be achieved in work of all the crew members. From the very first flights the pilot should pay especial attention to coordination of actions of all the crew members on the ground and in the air as well.

It should be a strict rule that each member of the crew timely reports to the pilot on his actions in flight.

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Chapter II

Section I

OPERATING LIMITATIONS

Limitations by Weight and Balance

1. The helicopter normal all-up weight includes the weight of the empty helicopter, crew, oil contained in the power plant oil system, fuel in all fuel tanks, and payload of 6000 kg.
 2. The maximum all-up weight of the helicopter exceeds the normal weight by 2000 kg due to increase of payload from 6000 to 8000 kg.
 3. When the weight of the carried payload exceeds 8000 kg, the amount of fuel on the helicopter should respectively be decreased.
 4. The all-up weight of the helicopter with the external tanks should not exceed the maximum all-up weight.
 5. The normal all-up weight of the helicopter totals to 40,000 kg. The maximum all-up weight amounts to 42,000 kg.
- Note: The all-up weight of helicopters may differ from the specified values by 500 kg.

6. Tolerated longitudinal balance of the helicopter is the following:
 - frontmost CG position - 360 mm in front of the main rotor axis of rotation;
 - rearmost CG position - 220 mm aft of the main rotor axis of rotation (provided that the helicopter is completely

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fuelled up but carries no payload) or 200 mm aft of the main rotor axis of rotation (provided that the helicopter is completely fuelled up and carries the payload in the cargo compartment).

7. The helicopter balance will be kept within the specified limits provided that the following requirements are met:

- all the loads should be accommodated in line with the marks furnished on the starboard of the cargo compartment;
- at normal flying weight the helicopter may airlift 65 persons. When less than 65 persons are carried, they should be arranged in the cargo compartment in accordance with the sequence of seat numbers;
- fuelling up of the helicopter is to be performed in full compliance with the procedure specified in the Operating and Maintenance Instructions;
- fuel should be consumed from the fuel tanks in the sequence ensured by the automatic control system which governs the operation of the fuel tank booster pumps;
- all the loads in the cargo compartment should be arranged in symmetry with the helicopter longitudinal axis. When this is impossible, the lateral moment of the asymmetrically arranged loads should not exceed 4000 kg-m. In case of symmetrical accommodation of loads, flight with one fuelled up external tank may be performed.

8. Maximum altitudes of flight:

With normal all-up weight	With maximum all-up weight
4500 m	3000 m

Limitations by Performance Data and Manoeuvrability

9. Depending upon the altitude, the level flight with normal all-up weight may be performed at the following indicated airspeeds:

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Altitude, m	Maximum indicated airspeed, km/hr	Minimum indicated airspeed, km/hr
50	300	80
500	300	80
1000	300	80
2000	270	80
3000	240	110
4000	190	110
4500	165	110

Note: Flying at altitudes below 50 m should be performed at speeds up to 30 km/hr.

10. Depending upon the altitude, the level flight with maximum all-up weight may be performed at the following indicated airspeeds:

Altitude, m	Maximum indicated airspeed, km/hr	Minimum indicated airspeed, km/hr
50	250	110
1000	250	110
2000	220	110
3000	190	110

11. In durable flight the indicated airspeeds should not exceed the following values:

Altitude, m	Indicated airspeed, km/hr	
	at normal all-up weight	at maximum all-up weight
50	250	230
1000	250	230
1500	240	225
2000	230	220
3000	220	190
4000	190	-
4500	165	-

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12. At the given altitude and at all states of flight performed with normal or maximum all-up weight, the main rotor rpm (in percentage) may be changed within the following tolerated limits:

Altitude, m	Main rotor rpm (as read off tachometer), %			
	minimum permissible	recommended	maximum recommended	maximum permissible
0	78	79+1	83	87, for not over 5 min
1000	78	79+1	83	87, for not over 5 min
2000	80	81+1	83	87, for not over 5 min
3000	82	83+1	85	87, for not over 60 min
4000	84	85+1	87	87, for not over 60 min
4500	85	85+1	87	87, for not over 60 min

- Notes:
1. The accumulated service hours of the rotor turbine at rpm amounting to 87 % should not exceed 5 % of the engine life.
 2. During vertical take-off and landing as well as in checking the collective pitch-throttle control system on the ground a main rotor overspeed up to 90% is permitted for not more than 1 min with the engines running at 0.85 of the normal rating.
 3. When the helicopter is hovering near the ground, the best rpm of the main rotor comprise 80 - 82 %.

13. When hovering, the normal turns may be performed with the rate not exceeding 10 deg/sec.

14. At the wind velocity of 10 m/sec the normal turns in hovering at sea level may be performed only through 90° from the head wind direction. At the wind velocity of 5 m/sec complete turns through 360° may be performed.

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15. Helicopter manoeuvring near even ground is to be performed at a speed of 15 km/hr. In this case excellent look-out should be displayed.

16. When flying over broken country (ravines, and the like) the helicopter should not descend below the absolute altitude of 50 m and its indicated airspeed should not be less than 60 km/hr so as to avoid the ground cushion effect.

17. Main rotor speeding up and stopping, helicopter hovering, take-offs and landings, both vertical and normal, may be performed at the following wind directions and speeds:

Wind direction	Permissible wind velocity, m/sec	
	during main rotor speeding up and stopping	during take-off and landing
head wind	20	20
side wind	10	10
tail wind	5	5

18. Turns and banked turns may be performed:

- at normal all-up weight with bank not over 30° and at indicated airspeeds from 80 to 250 km/hr;
- at maximum all-up weight with bank not over 15° and at indicated airspeeds from 110 to 230 km/hr.

19. Depending upon the altitude of flight, helicopter power gliding at normal all-up weight may be performed at the following speeds:

Altitude, m	Recommended indicated airspeeds, km/hr	Permissible indicated airspeeds, km/hr	Vertical speed of descent, m/sec
4500 - 4000	110 - 130	110 - 145	Not over 4
4000 - 3000	110 - 140	110 - 160	Same
3000 - 2000	120 - 160	110 - 190	Not over 7
2000 - 1000	120 - 160	100 - 230	Same
1000 - 0	120 - 160	100 - 250	Same

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20. From the altitude of 3000 m to the ground the helicopter power gliding at all-up weight exceeding the normal one may be performed at the indicated airspeeds within 110 and 230 km/hr, ^{depending on the altitude} the respective recommended speeds being 120 - 160 km/hr.

21. In power gliding the main rotor rpm, both for normal all-up weight and maximum all-up weight, should be maintained within the range specified for the level flight at the respective altitudes.

22. Gliding at autorotation may be performed at the indicated airspeeds from 120 to 250 km/hr, ^{depending on the altitude} Turns at autorotation may be carried out at the maximum bank of 20°.

Limitations for Flying in Adverse Weather
Conditions

23. Flights in clouds should be performed at the altitude not exceeding 3000 m and at the following indicated airspeeds:

Altitude, m	Indicated airspeed, km/hr	
	with normal all-up weight	with maximum all-up weight
Up to 1500	140 - 250	140 - 230
From 1500 to 3000	140 - 240	140 - 190

24. In instrument flying the bank of normal and banked turns should not exceed 20°.

25. Flying under icing conditions may be effected for not over 1 hour at the ambient air temperature not below -15°C.

Limitations for Flying with Engaged Autopilot

26. The minimum altitude for flying under autopilot control is 100 m. The autopilot is to be engaged at the straight path of the controlled flight (level flight, climbing gliding) at any permissible speed. When flying with the rearmost balance the autopilot should be engaged not earlier than 30 min after taking-off. Otherwise inadvertent dis-

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Section II
Pre-Flight Preparation

The responsibility for performing a thorough inspection of the helicopter pre-flight preparation lies on the flight engineer considered to be the senior for all those engaged in the inspection.

Pre-Flight Inspection of Helicopter
Flight Engineer

The pre-flight inspection should be performed by the flight engineer in accordance with the maintenance Instructions.

During the pre-flight inspection the flight engineer should do the following:

1. Examine the main rotor blades for damage.
2. Examine the blades of the tail rotor for damage.
3. Make sure that the helicopter is ready for the mission to be carried out; check that the weight does not exceed the tolerated limit and that the cargo is accommodated in accordance with the marking furnished in the cargo compartment attached.

4. Check the oil level in the engine.

Note: When checking the oil level during continuous parking, bear in mind that 9 - 10 lit of oil may flow from the engines. Therefore do not check the oil level by 10 lit and there are no traces of oil in this case the oil level after testing the engines and oil tanks are properly filled.

5. Check the oil level in the main gearbox and replenish the oil if necessary.
6. Check filling up of hydraulic system.

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15. Helicopter manoeuvring near even ground is to be performed at a speed of 15 km/hr. In this case excellent look-out should be displayed.

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Wind direction	Permissible wind velocity, m/sec	
	during main rotor speeding up and stopping	during take-off and landing
head wind	20	20
side wind	10	10
tail wind	5	5

18. Turns and banked turns may be performed:

- at normal all-up weight with bank not over 30° and at indicated airspeeds from 80 to 250 km/hr;
- at maximum all-up weight with bank not over 15° and at indicated airspeeds from 110 to 230 km/hr.

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Altitude, m	Recommended indicated airspeeds, km/hr	Permissible indicated airspeeds, km/hr	Vertical speed of descent, m/sec
4500 - 4000	110 - 130	110 - 145	Not over 4
4000 - 3000	110 - 140	110 - 160	Same
3000 - 2000	120 - 160	110 - 190	Not over 7
2000 - 1000	120 - 160	100 - 230	Same
1000 - 0	120 - 160	100 - 250	Same

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engagement of the autopilot by the limit switch may happen at the beginning of the flight due to considerable deflection of the control stick forward.

WARNING: Do not abandon the foot control pedals when engaging the autopilot or flying under autopilot control at altitudes below 300 m.

Limitations for Flying with Loads Attached
to Sling System

27. Maximum all-up weight (including externally attached load) is 37,500 kg and with length of main wire rope about or over 20 m it amounts to 36,000 kg.

28. Maximum weight of externally attached load is equal to 8000 kg.

29. Maximum speed of flight with load attached to the sling system is 200 km/hr. (Sometimes this value may be less. In each flight with externally attached load the pilot must be sure that the established maximum speed of flight prevents touching of the main wire rope against the limiting ring).

30. To keep the helicopter balance within the permissible limits, the following regulations should be observed:

- fuelling up of the helicopter should be carried out in compliance with the procedure prescribed in the Operating and Maintenance Instructions (the amount of the filled fuel depends on the maximum all-up weight of the helicopter);
- fuel should be consumed in sequence ensured by the automatic control system.

31. Flights with loads on the sling system may be performed at the wind velocity not over 10 m/sec.

32. The load should be evenly raised from the ground (the instant the load becomes airborne the helicopter vertical speed should not exceed 1 m/sec).

33. Never make turns in hovering near the ground with the externally attached load and all-up weight of 36,000 kg.

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Section II

Pre-Flight Preparation

The responsibility for performance of detailed and thorough inspection of the helicopter within the scope of the pre-flight preparation lies on the flight engineer who is considered to be the senior for all the maintenance personnel engaged in the inspection.

Pre-Flight Inspection of Helicopter by
Flight Engineer

The pre-flight inspection should be performed by the flight engineer in accordance with the Operating and Maintenance Instructions.

During the pre-flight inspection the flight engineer should do the following:

1. Examine the main rotor blades for dirt and external damage.
2. Examine the blades of the tail rotor for mechanical damage.
3. Make sure that the helicopter is loaded in line with the mission to be carried out; check to see that the all-up weight does not exceed the tolerated limits; make sure that the cargo is accommodated in accordance with the balance marking furnished in the cargo compartment and is securely attached.
4. Check the oil level in the engine oil tanks.

Note: When checking the oil level after the helicopter continuous parking, bear in mind that about 9 - 10 lit of oil may flow from the tanks into the engines. Therefore do not fill up the oil tanks if the oil level is by 10 lit below the rated value and there are no traces of oil leakage. However, in this case the oil level should be checked again after testing the engines to make sure that the oil tanks are properly filled up.

5. Check the oil level in the main gear box oil system and replenish the oil if necessary.
6. Check filling up of hydraulic system reservoir.

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7. Check the pressure of the fire extinguishers against the pressure gauge readings. Make sure that the readings comply with the data given in the Table furnished in the fire bottle compartment.

8. Check the air pressure of the air supply system. Boost-charge the air system from the ground air bottle when the pressure is less than 40 kg/cm².

9. Inspect the crew cabin. In so doing:

- (a) make sure there are no foreign objects in the cabin;
- (b) visually examine the instruments;
- (c) check the operation of the controls; to this end, switch on the 465M electric pump of the main hydraulic system (or the ground hydraulic installation), build up normal pressure, and check the operation of the controls by displacing the control stick and foot control pedals. Simultaneously check the operation of the spring-feel mechanisms and their indicators; switch on the 465M electric pump of the auxiliary hydraulic system, build up normal pressure in the system, and check the operation of the lock of the collective pitch-throttle control lever. At normal pressure in the main hydraulic system shift the collective pitch-throttle control lever from the lower stop to the upper one and backward. Simultaneously check the operation of the collective pitch indicator. Check by feel that the controls move without jerks and jamming;

- (d) check the circuits of the fire warning system and reliable operation of the distributing fire-fighting valves. To this end:

- cut in the circuit breaker of the fire fighting system;
- cut in the fire fighting system switch;
- place the selector switch at the FIRE DETECTOR TEST position; in so doing the fire detector test red warning lamp will come on;
- place the channel selector at the 1 CHANNEL position;
- turn the knob of the rotary switch clockwise from "1" to "9" position and back; in so doing the red warning lamps VALVE MANUAL OPENING will successively come on and go out.

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With the rotary switch placed at the "0" position, all the warning lamps should be off;

- follow the procedure specified in previous item to check the fire detectors by groups for the 2-nd and 3-rd channels;

- when the rotary switch is placed at the "1" and "2" positions (being shifted from the "0" position), the green warning lamp of the left engine air blow-off bands will go out, and when the rotary switch is placed at the "3" and "4" positions, the green warning lamp of the right engine air blow-off bands will go out to indicate that the blow-off bands of the respective engine are closed.

When the rotary switch is brought to any other position the lamps of the air blow-off bands will come on again to indicate that the blow-off bands are opened;

- complete checking the operation of the fire detectors for which purpose place the rotary switch at the "0" position and shift the channel selector to the neutral position;

- turn the selector switch at the FIRE EXTINGUISHER position. In so doing the fire detector test red warning lamp will go out;

- place the fire fighting system switch at the ON position.

Note: When checking the fire fighting system, do not fail to check automatic closing of the fan assembly vanes. To this end:

- build up the pressure of 60 kg/cm² in the hydraulic system;
- cut in the circuit breaker FAN ASSEMBLY VANES AUTOMATIC CLOSING;
- place the rotary switch at the "5" or "6" position (gear box compartment). In so doing the fan assembly vanes will automatically close. To open the vanes of the fan assembly, place the B-45 fire fighting system switch first at the OFF position and then at the ON position.

WARNING: When the rotary switch is brought to the "0" position but the red warning lamp VALVE OPENED does not go out, do not place the selector switch at the FIRE EXTINGUISHER position to avoid operation of the automatic shot fire bottles.

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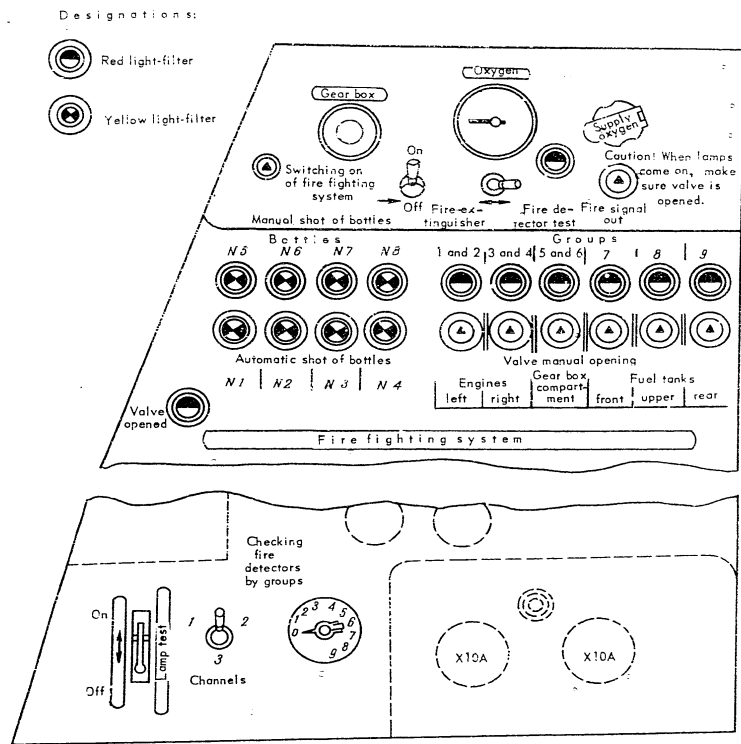


FIG. 1. FIRE FIGHTING CONTROL PANEL ON FLIGHT ENGINEER'S CONTROL PANEL

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(e) check the availability of the hand-operated fire extinguishers;

(f) check the operation of the windshield wipers;

(g) check the operation of the wheel braking system (after the wheel brakes are released there should be no residual pressure in the brakes);

(h) check the amount of fuel in the fuel tanks against the fuel gauges mounted on the flight engineer's and co-pilot's instrument panels;

(i) successively switch on the fuel booster pumps of the upper and lower fuel tanks and check the operation of the pumps against the warning lamps;

(j) check the operation of the inlet guide vanes of the oil cooler fan.

Upon completion of the inspection and preparatory operations the flight engineer must report about flight readiness to the pilot.

Pre-Flight Inspection of Helicopter by Pilot

On obtaining the report from the flight engineer on flight readiness, the pilot should inspect the helicopter in accordance with the mission to be carried out.

During visual inspection of the helicopter the pilot must do the following:

- check the main rotor for condition of blades (there should be no punctures, dents, ice or snow), condition of trim tabs and glasses of blade tracking lights;
- check the tail rotor blades for nicks and deep scratches;
- check the fuselage, tail boom and pylon for damaged skin, loose rivets, presence of ice or snow. Check condition of antennas and pitot-static tubes. Make sure that the access panels, cowls and platforms of the engines and gear box are closed, the plugs are removed from the engine air intakes, fan assembly, and exhaust pipes. Perform the check for leakage of fuel, oil, and other fluids;

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- check the stabilizer and wing for damaged skin, ice, and snow. Make sure that the wing is fixed in the position for the powered flight;

- check the landing gear for condition of the shock struts (for dirt and normal projection of inner tube), for condition of wheel tyres (tyres should not be damaged and should be properly inflated). At normal all-up weight the projection of inner tubes of the main and nose shock struts should comply with the data of Tables on the struts. Main wheel tyre deflection should equal 140 mm, and nose wheel tyre deflection, 80 mm;

- check the tail bumper for secure attachment and for damage;

- check the external fuel tanks for proper attachment and leakage;

- make sure that there are no foreign objects around the helicopter that may get into the blades of the main and tail rotors.

When inspecting the pilots' cabin, the pilot should make sure that:

- there are no foreign objects in the cabin;
- cabin glass panels are not dirty;
- harness is properly arranged;
- seat, back-rest, and pedals are adjusted to fit the pilots;
- all the controls are in proper position and the instruments are in good condition;
- moving blisters in the cabin properly open and close;
- brake system is charged with air (pressure gauge should read at least 40 kg/cm²);
- clock is wound and shows correct time;
- altimeter pointers are set at "0" and barometric pressure indicated by the altimeter corresponds to the meteorological data;
- circuit breakers and switches are cut out;
- oxygen equipment operates properly (to be checked only before high-altitude flight).

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Having completed visual inspection of the helicopter, the pilot should give the command to the flight engineer to connect the power. After this the pilot must cut in the required circuit breakers and switches, check functioning of the spring-feel mechanisms from the stations of pilot and co-pilot, shift the spring-feel mechanisms under the pilot control and place them at the neutral position.

After this the pilot should check serviceability of the PB-2 radio altimeter by dancing of the altimeter pointer about the zero.

Then the pilot should obtain reports from the crew members on readiness of the helicopter for engine starting, check serviceability of the V.H.F. radio set and establish communication with the flight control tower.

Pre-Flight Inspection of Helicopter by Co-Pilot

During the pre-flight preparation the co-pilot must check the cargo for amount, proper accommodation and secure attachment and inspect the cargo compartment.

When the helicopter is going to airlift passengers, the co-pilot should check number of persons and their accommodation on the seats and instruct the passengers that they should not abandon their seats till the helicopter makes landing. At normal all-up weight the number of persons carried in the helicopter should not exceed 65; all of them should be accommodated only on seats. With filled up external fuel tanks and topped up main fuel tanks the number of transported passengers should be reduced: for normal all-up weight - to 25 persons, for maximum all-up weight - to 45 persons. In these cases the passengers should occupy the seats in numbering sequence (starting from seat No.1).

When the helicopter is going to carry loads, the co-pilot must check:

- total weight of payload and its accommodation taking into account the tolerated stresses on the cargo compartment floor; at normal all-up weight and topped up fuel tanks the weight of the payload should not exceed 6000 kg, and at

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maximum all-up weight, 8000 kg; when airlifting the payload 12,000 kg, the amount of fuel should be reduced by 4000 kg (in this case the all-up weight of the helicopter will correspond to the maximum all-up weight); with filled up external fuel tanks the weight of the payload should not exceed 2500 kg for the normal all-up weight and 4500 kg for the maximum all-up weight;

- load accommodation: the CG of the load arranged along the cargo compartment should be positioned between the blue and red arrows (on the starboard); so far as lateral direction is concerned, the load should be arranged symmetrically. When the symmetrical arrangement of the load is not possible, the cargo should be so accommodated that the moment of the asymmetrical loads relative to the centre of the cargo compartment floor does not exceed 4000 kg-m;

- safety securing of the load to the attachment rings.

Pre-Flight Inspection and Check-Up of Equipment by Navigator

Prior to starting the inspection, the navigator should inquire special equipment technicians on preparation of the instruments and radio-navigational aids for the flight and on elimination of the faults and troubles revealed in the previous flight.

During visual inspection of the helicopter the navigator should do the following:

- check the antennas of the APK-5 automatic radio compass for mechanical damage;
- make sure that cases are removed from the pitot-static tubes;
- make sure that cabin glass panels are not broken;
- make sure that covers are removed from the ЖКОИ-39 signal flare holder and check availability of signal flares;
- check to see that protective jacket is removed from the course setter (fuselage upper portion);

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- When inspecting the cabin, the navigator should check:
- position of switches on the electric board; all the switches should be at the OFF position;
 - external condition of BQ-10 altimeter, VC-350 speed indicator, A4XO clock, PTK-1 gyro-induction compass, PTK-52 directional gyro and APK-5 automatic radio compass;
 - serviceability (by visual inspection) of control panels of PTK-52 directional gyro, APK-5 automatic radio compass and ЗКОП-39 signal flare holder;
 - serviceability (by visual inspection) of КП-18M oxygen set;
 - condition of seat and harness;
 - serviceability of KM-12 compass;
 - presence and condition of AB-52 drift sight;
 - presence and condition of MAC-1 sextant.

Having completed the inspection, the navigator should set exact time at A4XO clock and at all helicopter clocks of crew members and adjust the BQ-10 altimeter to the barometric pressure of the airfield of departure.

Checking Energized Equipment by Navigator

After starting the engines or after connecting the ground power supply, the navigator should check the serviceability of navigational means. To this end, he must cut in the respective switches on the electric board and successively check the APK-5 automatic radio compass, PTK-1 gyro-induction compass, PTK-52 directional gyro, and AB-52 drift sight.

Checking APK-5 automatic radio compass. Connect power and tune the automatic radio compass to the frequency of the outer marker beacon. Listen to the call signals, check the radio station relative bearing and rotation of the loop by hand. On completion of the check, disconnect the power.

Checking PTK-1 gyro-induction compass. Depress the slaving button three minutes after connection of the power. Check the gyro-induction compass for correct readings by comparing its readings with those of the KM-12 compass. Difference in readings should not exceed the magnitude of the compass deviation.

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15-20 min after engage-
 ment the directional gyro should yield stable readings. Set
 the amplitude of the point of departure. Compare the trans-
 mitter readings with the repeater indications. The difference
 in readings should not exceed $\pm 1^\circ$. When the push-button
 switch of the course setter is set to "N" - "П" index, the
 scale will rotate with the rate of 10-25 per 1 min. When this
 switch is set to the stop, the scale will turn with the rate
 of not less than 180° per 1 min.

Checking AB-52 drift sight. The AB-52 drift sight is to
 be checked within the terms established for checking the navi-
 gation instruments. When checking the drift sight, proceed
 as follows:

(a) check condition of the pantograph. To this end,
 match the zero mark of the drift scale with the index and draw
 on the transparent disc a pencil line in the direction of one
 of the drift grid lines (pantograph indicator is to be shift-
 ed exactly along the drift line); the drawn line should not
 deviate from parallel lines on the movable disc by more than
 0.5° ;

(b) check the drift grid for parallel alignment with
 the helicopter axis of symmetry, proceeding as follows:

- pull a cord on the ground in parallel with the heli-
 copter axis of symmetry;
- looking into the eyepiece, align the sight drift lines
 in parallel with the cord and check the matching of the index
 with the zero mark of the drift scale;
- if the zero mark of the drift scale is not matched
 with the index, undo the index and shift it towards the zero.

Before the flight the navigator should visually check
 the drift sight for proper condition and for transparency of
 its optical system. The navigator must check also the
 presence and serviceability of the stop-watch.

Before night flying the navigator should check the con-
 dition of the illumination lamps.

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Pre-Flight Inspection and Check-Up of
Equipment by Radio-Operator

During visual inspection the radio-operator must check to see that:

- antenna equipment of 1-PCB-70 radio set and V.H.F. radio set is serviceable, through insulators are not dirty and are free of mechanical damage;
- antenna leads are properly and reliably connected to the radio sets;
- all the equipment of the radio-operator's station is securely attached and power plugs are connected;
- tuning tables for 1-PCB-70 radio set are available (make sure that the tuning tables belong to the given radio set), spare fuses and set of spare tubes are contained in sealed boxes;
- all the switches are in the OFF position;
- seat is in good order and harness is properly arranged.

Checking energized equipment. Make sure that the ground power supply is connected (or helicopter power if the engines are started), cut in the respective switches on the electric board, and successively check 1-PCB-70 radio set and CHY-7 interphone system.

Checking 1-PCB-70 radio set. Switch on the receiver and check it for proper operation by monitoring transmitting radio sets at all bands in the telephone and telegraph modes of operation.

Switch on the transmitter and make sure it operates properly. If it is necessary, establish two-way communication with the airfield radio set. The channels to which the communication and command radio sets should be tuned are specified in the communication plan elaborated during preparation for flight.

Checking CHY-7 interphone system. Make sure that the interphone system is fed with A.C. current of 115 V and check communication with all the crew members. Report flight readiness to the pilot.

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Engine Starting and Ground Test of Power Plant

Ground test of the power plant may be performed only by the pilot.

Preparation for Starting

When several helicopters are to be subjected to the ground test, their engines should be started in such a succession that during speeding up of the main rotor the latter is not affected by the air stream induced by earlier started helicopters.

WARNING: During starting, stopping or testing the engines the wind speed should not exceed the following values: head wind - 20 m/sec, side wind - up to 10 m/sec, tail wind - up to 5 m/sec.

Avoid starting the helicopter engines on the sandy or dusty soils; if it is necessary to start the engines on the mentioned soils water the ground space.

Make sure that there are no foreign objects about the helicopter and check availability of fire fighting equipment.

All the crew members should take their seats.

Give an order to connect the ground power supply or to cut in the helicopter storage batteries.

To accomplish engine starting from the ground power supply, connect two power sources of 24 V each to the helicopter supply sockets. In so doing the signal lamps will glow on the flight engineer's instrument panel. The voltage of the power sources is to be checked by operating the voltage test selector on the flight engineer's instrument panel.

Cut in the following circuit breakers required for engine starting: circuit breakers of instruments and indicators of the power plant, hydraulic systems (main, duplicating, and auxiliary), fire fighting system, shutoff valves, fuel control system, starting system, spring-feel mechanism control system, spring-feel mechanism and collective pitch indicators, A.C. generators, NO-1500 inverter and warning system testing.

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Lower the braking lever fully down to unbrake the main rotor.

Check the position of the controls and place them as required for starting. To this end:

- place at the neutral position (at the middle latch) the engine selector controls and lock them in this position;
- check against the pitch indicator that the collective pitch-throttle control lever is in the lower position, the twist grip is fully turned counterclockwise, pointers of the fuel lever position indicator read 15-18°; if it is necessary to shift the collective pitch-throttle control lever, build up, first, the required pressure in the main hydraulic system;
- displace the longitudinal spring-feel mechanism by 1 - 1.5 divisions backward, and the lateral spring-feel mechanism by 0.5 - 1 division to the right.

Place the fire fighting system switch at the ON position.

Make sure that the priming valves of fuel tank groups Nos III and IV are closed (warning lamp CLOSE PRIMING VALVE does not burn). Check to see that the warning lamps indicating to opening of the cargo compartment door panels and engine and gear box cowls are off.

Operate the electric pump (or hand-operated pump, if the electric one is faulty) to build up the pressure of 60 kg/cm² in the auxiliary hydraulic system and maintain this pressure till the pump of the auxiliary hydraulic system starts operating.

WARNING: When the ground power supply is not available, electric pumps 465M of the auxiliary and main hydraulic systems may be actuated only for 1 min (to prevent storage battery discharging).

Connect inverter NO-1500 and make sure that A.C. current of 115 V is supplied. See that the pointers of the fuel and oil pressure gauges of the engine and gear box systems read zero.

Make sure that the switches of the D.C. generators are in the OFF position.

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Give an order to crank the engines (engines are to be cranked after 5-day parking).

Place the switches as follows:

- function switch, at the CRANKING position;
- engine starting selector, at the engine to be cranked.

Place the engine stop cocks at the CLOSED position.

Cut in the fuel booster pump.

Open the fuel shutoff valves of both engines and check against the pressure gauge the magnitude of fuel pressure before the HP-23A pump.

Depress the starting button of the cranked engine for 1 - 2 sec and perform cold cranking. The rpm of the compressor rotor during cranking should reach 10 - 15 %. Time of cold cranking is determined by the automatic starting system and amounts to 28 - 32 sec.

During cranking keep an eye on the engine oil pressure gauge which should read at least 0.2 kg/cm².

Listen to the running-down engine operation after disengagement of the starter-generator.

Crank the second engine proceeding in the same manner.

Engine Starting

Succession of engine starting depends on the wind direction and on accumulated service hours of the engines.

Starting of the engines goes on automatically and should be performed as follows. Actuate electric pump 465M of the main hydraulic system to build up the pressure at least of 90 kg/cm² which will prevent "drift" of the cyclic pitch control stick during main rotor acceleration.

To avoid extensive leakage of the hydraulic fluid and rapid drop of pressure in the hydraulic system, place the switch of the main hydraulic system at the ON position when the blades of the main rotor start rotating.

Warn about beginning of starting.

Place the function switch at the STARTING position.

Set the engine starting selector to the engine to be started.

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Shift the engine stop cocks to the CLOSED position. In so doing make sure that the pointers of the fuel lever position indicators read 15° - 18° .

Depress the starting button of the engine to be started for 1 - 2 sec. In so doing the warning lamp of the started engine AUTOMATIC STARTING ON will get burn on the central console and will keep burning for 46±3 sec after depressing the button. As the compressor rotor gains 1000 - 1500 rpm (9 - 14 %), shift the engine stop cock to the OPEN position.

Note: Depending upon the ambient air temperature, the engine stop cock should be shifted to the OPEN position at the following rpm of the engine (compressor):

Compressor rpm	Ambient air temperature			
	above 0°C	from -1° to -15°	from -16° to -30°	below -30°
"compressor" %, as read from WT3-2 tachometer indicator	12 - 14	11 - 12	10 - 11	9 - 10

After the starting button has been depressed, the engine will automatically develop the slow running rpm (51.7±1 %) for a time period not over 120 sec. During engine starting and developing the slow running rpm the turbine outlet temperature should not exceed 600°C .

When starting the engine, the pilot should check:

- amount of voltage supplied by the ground (helicopter) power source;
- rise of fuel and oil pressure in the engine;
- rise of turbine outlet temperature (it should not be over 600°C);
- rise of oil pressure in the free turbine, in the main, intermediate and tail gear boxes (during starting oil pressure in the intermediate and tail gear boxes may reach the maximum values of the pressure gauge scales);

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rise of pressure in the main and duplicating hydraulic systems;

WARNING: When after starting the engines the duplicating hydraulic system operates instead of the main hydraulic system (red light panel of the duplicating hydraulic system is burning and green warning lamp of the main hydraulic system is off), switch off the circuit breaker of the main hydraulic system arranged on the flight engineer's panel and then switch it on again.

- disengagement of the starter-generator (to be checked by the warning lamp) which should be accomplished automatically at the end of 46±3 sec after depressing the starting button or at the engine rpm of 32.9±1 % (as indicated by the tachometer).

WARNING: If the starter-generator fails to be automatically disengaged, accomplish the disengagement manually by depressing for 1 - 2 sec the disengagement button.

As the engine develops the slow running rpm, oil pressure in the engine should equal at least 2 kg/cm² and turbine outlet temperature should not exceed 550°C.

Place the engine starting selector to the position for starting the other engine and accomplish its starting proceeding in the same way.

Notes: 1. The ignition system operates automatically (together with the starter) after depressing the starting button.
2. During first 8 min of starting, "rushes" of current may happen after which the current will set to the value of 450 A drained by the starter-generator at a voltage of 40 - 48 V. The voltage is to be checked against the inboard voltmeter with the selector placed at the I SOCKET position. If the voltage drops below 18 V, the engine may fail to develop the slow running rpm.

The engine starting should be discontinued provided that:

- turbine outlet temperature exceeds 600°C;
- the lamp of the 4C-23 chip-detecting filter comes on;
- in the course of starting the engine stops speeding up;
- the starter-generator is not disengaged automatically

or manually;

- fuel fails to ignite;

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- fuel or oil leakage or other faults are detected in the operation of the engine or its accessories;

- surge of oil pressure in the engine or gear box is detected;

- self-excited ground vibrations (ground resonance) arise;

- at $n_{\text{compressor}} = 1000 - 1500$ rpm no oil pressure is built up at the inlet of the engine after the MHP-23 pump (oil pressure as checked against the pressure gauge should equal at least 0.2 kg/cm^2).

Starting is discontinued by shifting the engine stop cock into the CLOSED position and by disengaging the starter-generator with the help of STARTING DISCONTINUED button unless it is disengaged automatically.

WARNINGS: 1. Re-starting may be performed only after full stop of the engine and not earlier than 3 min after the starter disengagement. Five re-startings may be tried.

2. After each five attempts to start the engine, an interval at least of 15 min should be allowed to ensure starter cooling. Next startings are to be accomplished only after eliminating the trouble.

3. When it is necessary to crank the engine immediately after starting, make sure that the pointers of the fuel lever position indicator read $15 - 18^\circ$.

4. Re-startings are to be accomplished only after eliminating the reasons for faulty starting.

When the engines are started, give an order to disconnect the ground power sources, successively cut in the D.C. generators, and place the CIRCUIT TO BATTERY selector at the OFF position. In so doing, the red lamps on the flight engineer's panel and the light panels which indicate to the generator failure will go out and the pointers of the ammeters will deflect from the zero marks by the amount corresponding to the drained current.

In case of a considerable difference in ammeter readings perform coarse adjustment of the generators by means of external resistors mounted on the flight engineer's panel.

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Final adjustment of the generators is to be carried out during ground test of the engines.

Make sure that the engines properly operate at the slow running and proceed to warming up the engines.

Warming Up Power Plant and Testing Engines

The engines and gear box are to be warmed up at slow running, at the compressor rotor speed of 5500±100 rpm (51.7±1 %), and at the minimum setting angle of the main rotor blades. The collective pitch-throttle control lever should be lowered till the stop and the twist grip should be turned fully counterclockwise.

At sub-zero ambient temperatures the speed of the compressor rotor at slow running may comprise 5100 rpm (48 %).

The main gear box is to be warmed up till the inlet oil temperature amounts to +25°C for summer oil and +5°C for winter oil.

In winter conditions the oil pressure in the intermediate and tail gear boxes may rise during starting to the maximum values of the pressure gauge scales (pointers of the pressure gauges rest against the upper stop).

When warming up the power plant, check the operation of the hydraulic boosters from the main and duplicating hydraulic systems actuating them successively by manipulating the switches mounted on the centre panel of the pilots' instrument panel. With both switches cut in, the main hydraulic system will operate.

The operation of the main hydraulic system is said to be normal provided that:

- at smooth (without jerks and jamming) displacement of the controls the pressure in the system varies within 120±5 - 155±5 kg/cm²;
- green lamp MAIN HYDRAULIC SYSTEM ON is burning;
- there is no pressure in the duplicating system (the pointer of the pressure gauge reads zero).

After checking the main hydraulic system and building up the normal pressure, disconnect the main system and displace

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the controls to make sure by the pressure gauge readings that the pressure in the duplicating system rises up. The duplicating system operates properly, provided that:

- at smooth (without jerks and jamming) displacement of the controls the pressure in the duplicating system varies within 120 ± 5 - 155 ± 5 kg/cm²;

- red light panel DUPLICATING HYDRAULIC SYSTEM ON is burning;

- green lamp MAIN HYDRAULIC SYSTEM ON is off;
- normal pressure is maintained in the main hydraulic system (to be checked against pressure gauge readings).

Check the operation of the auxiliary hydraulic system against the readings of the pressure gauge on the flight engineer's instrument panel and by connecting for a short period of time the hydraulic control of the pilots' seats. In so doing the pressure in the auxiliary hydraulic system will vary within 120 ± 5 - 155 ± 5 kg/cm². Start main hydraulic system.

After warming up the engines and gear box, check their operation and parameters at slow running, and proceed to testing the engines.

The pilot and flight engineer should be on their seats and communicate with each other through the CHY-7 interphone system.

Ground test of the engines is to be performed at the beginning of each flying day. The test includes checking the operation and parameters of the power plant at the following ratings: 0.66 of normal rating, 0.85 of normal rating, normal rating, combat rating, and take-off rating.

If the helicopter is not moored, the engines may be tested provided that the helicopter weight amounts at least to 32,500 kg (when the fuel tanks are topped up, the engines of the unloaded helicopter may be tested).

The engines should be tested in succession, i.e. first, one engine should be started, tested, and stopped, and then the other engine should be started and tested. Ground test should be performed by the pilot.

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The successive ground test of the engines is to be performed by means of engine selector control levers proceeding as follows:

- smoothly turn the twist grip fully clockwise. In so doing, the speed of the rotor turbine with one engine running may be less than 7800 rpm. In this case apply backward pressure to the engine selector control lever (without manipulating the collective pitch-throttle control lever) to increase the rotor turbine speed to 7800 - 8300 rpm (78 - 83 %);

- operate the engine selector control lever to establish the required rating of the engine (as checked against the VITE-2 fuel lever position indicator). In so doing, the speed of the rotor turbine should be maintained within 78 - 83 % by displacing the collective pitch-throttle control lever upwards, i.e. by increasing the load imposed on the rotor turbine. Successively establish the ratings of 0.66 of the normal, 0.85 of the normal, normal, combat, and take-off ratings. When increasing the engine rating, the rpm of the main rotor may reach maximum permissible values (87 %) and even exceed them. To reduce the speed of the main rotor, increase the blade pitch to $3 - 3,5^{\circ}$ as measured by the tachometer. In so doing, the speed of the main rotor will decrease and rating of the tested engine may be increased. Check all the instruments which control the operation of the tested engine for correct readings and make sure that their readings comply with the established rating. Smoothly reduce the rating of the engine to 0.85 of the normal rating and check adjustment of the tested engine generator. Set the engine to the slow running proceeding as follows: successively shift the engine selector control lever and collective pitch-throttle control lever downward by several steps. Place the engine selector control lever at the middle position (on the latch) and the collective pitch-throttle control lever, at the lowermost position. Operate the engine at the slow running for 2 - 3 min and shift the stop cock into the CLOSED position.

Test the other engine in the same manner.

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Engine Stopping

Establish the controlled slow running rating.

Operate the engine at slow running for 2 - 3 min, shift the stop cock into the CLOSED position and place the spring-feel mechanisms at the neutral position.

Check the time of engine run-down when the engine was cut off at the compressor rpm of 9.4 %. The run-down time of the compressor should equal 70 sec and that of the rotor turbines, at least 90 sec. When checking the engine run-down, make sure there is no foreign noise in the engine.

If the fuel consumption was controlled automatically, place the selector of fuel consumption control mounted on the flight engineer's panel at the MANUAL position.

Switch off the operating fuel booster pump, if the fuel consumption was controlled manually.

Close the fuel shutoff valves of both engines.

The engines are to be stopped immediately, provided that:

- oil pressure in the engines, main, intermediate, and tail gear boxes sharply drops;
- fuel and oil leakage is located which may cause fire hazard;
- turbine outlet temperature sharply increases;
- flame is effectively blown out of the exhaust pipe;
- engine starts vibrating;
- ice is built up in the air intake.

After stopping the engines, do not brake the main rotor if there is no necessity for it. When the main rotor fails to stop for a continuous period of time, brake it by periodically applying the brake till the rpm reaches 1 - 1.5 % as measured by the tachometer. To fully brake the main rotor, rapidly raise the brake lever.

When the engines do not operate, the main rotor should always be braked and the blades of the main rotor should be so positioned that not a single blade is located over the tail boom or stabilizer.

Before leaving the cabin, make sure that the spring-feel mechanisms are set neutral, collective pitch-throttle con-

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trol lever is fully lowered, and the lever of the main rotor brake is fully raised.

Cut off all the circuit breakers and disconnect power sources.

Preparation for Taxiing and Taxiing Proper

Preparation for Taxiing

The flight engineer should make sure that:

- ground power supply is disconnected and helicopter mains is cut in;
- all the circuit breakers required for take-off are switched on;
- grounding cable is arranged in the recess;
- service ladder is inboard and the door panels of the cargo compartment are closed.

The pilot should do the following:

- adjust the seat in height and make sure that it is locked;
- adjust tightening of the twist grip and collective pitch-throttle control lever;
- make sure that the engine selector control levers rest against the middle latch;
- check the hydraulic system for proper operation against the pressure gauge readings (pressure should equal $120 \pm 5 - 155 \pm 5$ kg/cm²);
- depress the brake control lever and check against the pressure gauge that the air pressure is available in the brake system;
- obtain the reports from the crew members on readiness of the helicopter for taxiing;
- obtain clearance from the flight control tower for taxiing;
- make sure that there are no obstacles in the direction of taxiing and release the parking brake.

The co-pilot should do the following:

- adjust the seat and pedals;

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- check the altimeters for proper barometric pressure;
- check the code for correct setting.
- The navigator should do the following:
 - take the seat, put on the parachute, attach the harness, connect the plug of the earphones to the plug of the interphone system cord, and check the communication with the crew members;
 - cut in the switches on the electric panel which are required for the flight. If it is necessary, switch on the circuit breaker (switch) of the pitot-static tube heating;
 - switch on the FTK-52 directional gyro and check setting of the latitude of the point of departure;
 - switch on the APK-5 automatic radio compass and tune it to the frequency of the outer marker beacon of the air-ports of departure;
 - slave the FTK-1 gyro-induction compass by depressing the slaving button;
 - before the high-altitude flight, open the valve of the XI-ISM oxygen set, connect the oxygen mask, and check the operation of the oxygen regulator;
 - report taxiing readiness to the pilot.

Taxiing

Taxiing is the basic method of helicopter movement on the ground. In taxiing the helicopter is stable and there is no difficulty in its control. When taxiing is not possible due to ground surface condition, perform hopping (flying the helicopter at very low altitudes).

During hopping, direction and velocity of the wind near the ground are to be considered. At the head wind up to 20 m/sec hopping should be performed without turns. At the wind velocity up to 10 m/sec hopping may be performed against the wind with turns through 90° relative to the wind direction. At the wind velocity below 5 m/sec hopping may be carried out in any direction with turns through 360°.

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When start taxiing, proceed as follows:

- fully turn the twist grip clockwise with the collective pitch-throttle control lever being positioned at 1° as checked against the indicator;

- wait until the rpm of the free turbine rise to 93 - 91 %;

- smoothly apply forward pressure to the control stick and begin movement; if the helicopter does not move, increase the power of the engines by increasing the collective pitch of the main rotor; as the helicopter starts taxiing, reduce the collective pitch to the previous value.

The taxiing speed should not exceed 20 km/hr. The speed is to be maintained constant by turning the twist grip and respectively displacing the control stick.

When taxiing on the dusty or snow-covered ground, wind direction and velocity should be considered. At the head wind, taxiing should be so performed that dust or snow raised by the air stream will be accumulated behind the crew cabin. When this is not possible, taxiing should be carried out at low speed and the helicopter should regularly be stopped for inspecting the taxiing strip.

When performing turns, one should bear it in mind that radius of turn varies directly with the taxiing speed.

Sharp turns during taxiing are not allowed as the helicopter will start skidding. Skidding in turns may happen also when the helicopter, whose weight is balanced by the lift, performs taxiing on the swampy or slippery surface.

To stop skidding, the pilot should decrease the engine power to the minimum, smoothly deflect the pedal in the direction of skidding, wait till the helicopter stops, then start taxiing and make a turn at a lower speed.

When making turns in taxiing, the pilot should remember about large size of the helicopter and exercise caution not to strike obstacles by the tail rotor.

To stop the helicopter during taxiing, reduce the engine power to the minimum, smoothly displace the control stick backward and apply the brakes.

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During taxiing the co-pilot and navigator should keep an eye on the taxiing strip and report all encountered obstacles to the pilot.

WARNING: When progressive vibrations of the helicopter rise in taxiing, decrease the pitch of the main rotor to the minimum, turn off the twist grip, reduce the taxiing speed or stop the helicopter. If the vibrations are not suppressed, immediately stop the engines.

Day Flights in Simple Conditions

Take-Off and Hovering

Hovering near the ground is to be performed before each flight for checking the helicopter control, balance, engine and transmission operation, and for determining the method of take-off.

If the helicopter is hovering at least 2 m off the ground and the engines properly operate at normal rating, vertical take-off may be performed. In all other cases the helicopter should perform running take-off or the helicopter flying weight should be reduced.

The CG position of the helicopter is determined by the amount of deflection of the spring-feel mechanisms after balancing the helicopter in hovering.

At normal balance the spring-feel mechanism of longitudinal control should be deflected through 0.5 - 1 division backward, and the spring-feel mechanism of the lateral control, through 0.5 - 1.5 divisions to the right.

At middle balance the main wheels of the helicopter are near the ground, though the height of hovering as determined from the pilots' cabin seems to be great.

The displacement of the CG position backward brings to increase of pitch angle, hence at the rearmost CG position the helicopter tail boom is considerably lowered.

This influence of the helicopter balance upon the helicopter attitude should be taken into account during displacement near the ground and especially during rearward displacements.

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To perform take-off and hovering, proceed as follows:

- position the helicopter upwind;
- check the instruments for proper readings;
- obtain reports from the crew members on readiness for take-off;
- turn the twist grip fully clockwise with the collective pitch-throttle control lever being set against 1° as checked by the indicator. Wait till the rpm of the main rotor reach 78 - 81 %;
- request clearance for take-off from the flight control tower;
- smoothly raise the collective pitch-throttle control lever to unstick the helicopter and gain the height required for hovering.

The collective pitch should be increased gradually for a time period of 5 - 7 sec. More energetic application of the collective pitch-throttle control lever may result in higher pitch angles of the main rotor and drop of its rpm.

During unsticking the helicopter tends to turn and bank to the left, hence the foot pedals and the control stick should be respectively deflected to prevent the helicopter from displacing and turning.

When the helicopter is symmetrically loaded and take-off is performed against the wind, normal hovering is effected with right bank and raised fuselage nose.

During hovering with the twist grip turned fully clockwise the rpm of the main rotor is maintained within 80 - 82 %. The minimum permissible rpm should equal 78 %, and the maximum permissible rpm, 87 %.

Turns in hovering may be performed at the rate not exceeding 10 deg/sec. In case of right turns the helicopter sinks and in case of left turns it gains the height.

Turns through 360° in hovering near the ground may be performed at the wind velocity below 5 m/sec. At the wind velocity up to 10 m/sec turns through 90° relative to the direction of the head wind are allowed. At the wind velocity over 10 m/sec only upwind hovering may be performed.

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All the displacements near the ground are to be carried out at a speed not over 15 km/hr, the helicopter position being checked against the ground.

WARNING: Due to great pitch angles in hovering, a considerable amount of fuel is remained in fuel tank group No. IV, after the fuel consumption automatic control system disconnects group No. IV and consumption of fuel from the fuel tanks of this group is discontinued. To consume this amount of fuel after take-off and entering the level flight, connect the fuel tanks of group No. IV manually or automatically. To accomplish automatic connection of the fuel tanks of group No. IV, switch off for a short period of time (for 1 - 2 sec) the AUTOMATIC FUEL CONSUMPTION circuit breaker mounted on the flight engineer's panel and then switch it on again.

During helicopter displacements there should be a certain reserve of height (at least 1.5 - 2 m over the obstacle) to prevent collision of the landing gear wheels with the obstacles.

The constant height of the helicopter is to be maintained by changing the collective pitch of the main rotor (by manipulating the collective pitch-throttle control lever).

Note: The tendency of the helicopter to turn and to make the left bank during unsticking may be explained by the following. For taking off, the pilot smoothly raises the collective pitch-throttle control lever to increase the power of the engines and the pitch angle of the main rotor blades. The thrust of the main rotor gradually increases. At some instant it exceeds the helicopter weight and helicopter unsticks. When the helicopter is sitting on the ground, the driving torque of the main rotor is counterbalanced by two moments: moment of wheel friction and moment of thrust of the tail rotor. As the helicopter unsticks, the moment of wheel friction disappears, which brings to the left turn of the helicopter (to the side of the driving torque action). The pilot prevents the helicopter from turning by respectively deflecting forward the right foot control pedal. Having reached the required height, the pilot decreases the power of the engines to ensure helicopter hovering.

During unsticking, the helicopter tends also to displace to the left. This tendency is caused by the thrust of the tail rotor. The pilot eliminates this effect of the tail rotor by deflecting the control stick to the right which changes the tilt of the main rotor aerodynamic force so that the component

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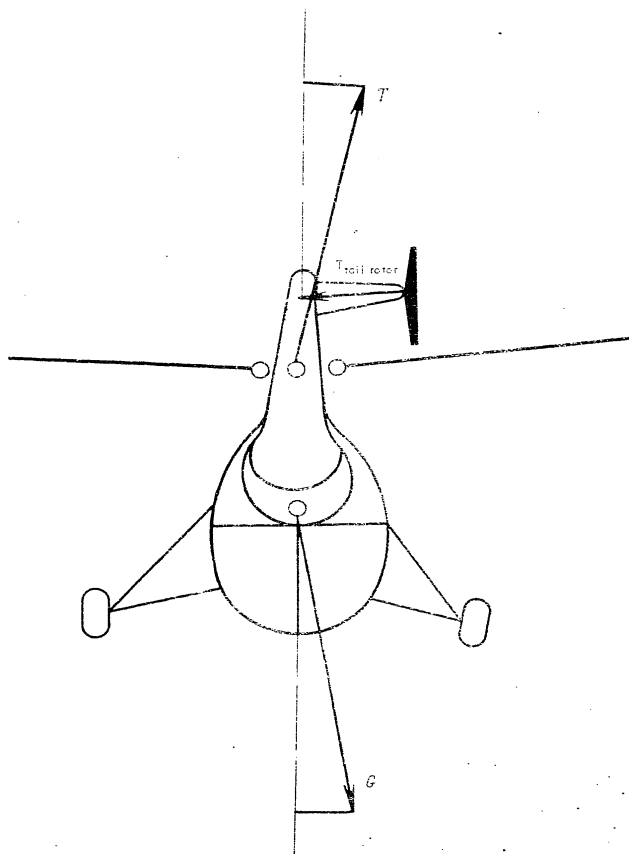


FIG. 2. DIAGRAM OF FORCES ACTING ON HELICOPTER IN HOVERING.

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of the latter is directed against the thrust of the tail rotor. However, the lateral balancing of the helicopter requires not only equilibrium of forces but also equality to zero of moments of forces relative to the helicopter longitudinal axis.

In case with Mi-6 helicopter, the axis of rotation of the tail rotor is positioned below the plane of the main rotor hub. Hence, the balancing of such helicopter during hovering may be obtained only at slight right bank (provided that the helicopter cargo compartment is symmetrically loaded in the lateral plane).

As the moments of forces relative to the longitudinal axis of the helicopter equal zero, the component of the main rotor aerodynamic force should be less than the tail rotor thrust since the arm of the thrust to the helicopter longitudinal axis is less.

The equilibrium of forces in the lateral plane is obtained due to the fact that the thrust of the tail rotor is counterbalanced by two forces: side component of the main rotor thrust and component of the helicopter weight. In forward flight the equilibrium of forces about the lateral axis may be obtained without banking due to the aerodynamic forces arising during left slipping. As a rule, in the forward flight the helicopter is balanced in the lateral plane both by banking and slipping.

Running Take-Off

Running take-off is to be performed after running on the ground till the indicated airspeed rises to 50 - 60 km/hr.

Running take-off is possible provided there is an even ground space at least 150 m long.

For taking off the helicopter should be positioned upwind (when it is necessary, take off may be accomplished at the side wind up to 10 m/sec and tail wind up to 5 m/sec). The pilot should always remember that taking off with the right side wind is rather complicated.

Obtain reports from the crew members on readiness for take-off.

Make sure that the instruments give proper readings, turn the twist grip fully clockwise with the collective pitch-throttle control lever being set at 1° as checked by the indicator. Wait till the rpm of the main rotor reach 78 - 81 % and obtain clearance for take-off.

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Move the control stick forward and gradually increase the collective pitch of the main rotor to obtain the take-off run speed amounting to 50 - 60 km/hr. With further increase of the main rotor collective pitch the engines will develop the take-off rpm (97° as measured by the fuel lever position indicator) and the helicopter will unstick.

If an excessive forward control stick pressure is applied during the take-off run, the landing gear main wheels may tear off the ground. To prevent this, properly deflect the control stick to keep the helicopter in the horizontal position till it unsticks. Gradually ascend at the indicated airspeed of 60 - 70 km/hr and enter into climbing.

After climbing to a sufficient height so that there is no danger of collision with obstacles, accelerate the helicopter to 130 - 140 km/hr, reduce the rating of the engines to the normal (84° as measured by the fuel lever position indicator), and go on climbing.

Maintain the rpm of the main rotor within 78 - 81 %.

Vertical Take-Off

For vertical taking-off, turn the twist grip fully clockwise with the collective pitch-throttle control lever set at 1° as measured by the indicator. As the main rotor rpm reach 78 - 81 %, gradually increase the collective pitch of the main rotor by operating the collective pitch-throttle control lever and allow the helicopter to unstick.

Gently apply forward control stick pressure and accelerate the helicopter to the speed of 60 - 70 km/hr with climbing to 30 - 50 m.

If the take-off was performed at the combat or take-off rating, establish the normal rating of the engines (84° as measured by the fuel lever position indicator) upon reaching the height of 30 - 50 m. The rpm of the main rotor should equal 78 - 83 %.

Transition from the hovering state to the indicated speeds of 50 - 60 km/hr should be performed energetically to pass rapidly the zone of small speeds which may cause helicopter vibration.

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During acceleration, the yawing and roll balancing of the helicopter suffers considerable changes, therefore the pilot should suppress the tendency of the helicopter to banking and turning by respectively deflecting the controls.

When the helicopter is accelerated with gain of height, the position of the control stick in the longitudinal direction depends in a large degree upon the rate at which the collective pitch-throttle control lever is displaced to increase the power of the engines.

The engine power should be changed gradually which reduces helicopter unbalancing.

If the normal rating or, which is worse, combat or take-off rating is energetically established during helicopter acceleration, the control stick will extensively displace forward and may reach the stop.

Low-Altitude Flights

Low-altitude flights may be performed for training purposes or for displacing the helicopter in the air when the taxiing is impaired by the surface condition.

During low-altitude flying the twist grip should be turned fully clockwise.

When carrying out low-altitude flights, keep the speed of displacement and height by use of the collective pitch-throttle control lever and control stick.

At heights up to 10 m perform flying at a speed not over 15 km/hr and check the position of the helicopter against the ground.

When performing low-altitude flights over broken country (ravines, gorges), maintain the absolute height at least 50 m and airspeed at least 60 km/hr to avoid the effect of the ground cushion.

Climbing

Climbing from the ground to an altitude of 3000 m is to be performed at the normal rating and speed of 130 - 140 km/hr.

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The rpm of the main rotor are to be maintained in compliance with the Table. In further climbing the airspeed should be reduced by 10 km/hr after every 1000 m.

During stable climbing the helicopter displays stability. The vertical speed of climbing at sea level amounts to 5 - 8 m/sec. At the height of 3000 m the vertical speed of climbing sharply drops and comprises only 1.5 - 2 m/sec.

At fixed position of the collective pitch-throttle control lever and twist grip, the rpm of the main rotor rise with increase of height.

The specified rpm of the main rotor and readings of the fuel lever position indicator are to be maintained by use of the collective pitch-throttle control lever and twist grip.

Having gained the required height, enter into the level flight proceeding as follows: do not change engine rating and manipulate the control stick to establish the speed of the level flight. Turn the twist grip and displace the collective pitch-throttle control lever to establish the engine rating corresponding to the specified speed of the level flight. Sharp application of the twist grip or collective pitch-throttle control lever is forbidden as this may bring the helicopter out of balance.

Level Flight

At the beginning of level flight check the fuel consumption automatic control system for proper operation. If this system is malfunctioning, shift the fuel consumption under the manual control maintaining the same sequence of fuel consumption so that the balance in flight does not exceed the permissible limits.

The level flight with normal all-up weight may be performed at the indicated airspeeds (with due regard to the altitude) specified in the Table:

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H, m	Indicated air-speed, km/hr		Main rotor rpm, %			
	maximum	minimum	recomm.	minimum permissible	maximum recommended	Maximum permissible
0	200	0	79+1	78	83	87, for not over 5 min
500	200	80	79+1	78	83	Same
1000	200	80	79+1	78	83	Same
2000	220	80	81+1	80	83	Same
3000	240	110	83+1	82	85	87, for not over 60 min
4000	190	110	85+1	83	87	Same
4500	165	110	85+1	85	87	Same

When flying at altitudes over 3000 m the pilot should exercise caution not to exceed the maximum tolerated rpm of the main rotor.

The maximum range of flight with normal all-up weight is obtained at the indicated airspeed of 230 km/hr and altitude of 2000 m. At the height from 0 to 1000 m the flight for maximum range is to be performed at the speed of 250 km/hr; at the height of 3000 m, at the speed of 220 km/hr; and at higher altitudes, at the maximum permissible speed.

When flying for maximum range with the maximum all-up weight of the helicopter maintain the speed of 230 km/hr at the altitudes from 0 to 1000 m, and the maximum permissible speed at all other altitudes.

In flight, regularly check the fuel consumption against the fuel gauge.

Banked turns are to be performed at speeds of 80 - 250 km/hr with bank up to 30°. When making banked turns, maintain the height constant by changing the collective

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pitch of the main rotor by means of the collective pitch-throttle control lever.

Enter into and recover from the banked turn by coordinated movements of the control stick and foot control pedals.

When flying with maximum all-up weight, do not create banks over 15° during normal and banked turns.

Transient States of Flight.

In transition from the vertical climbing state to the hovering state at the altitudes up to 10 m, discontinue climbing upon reaching the specified height by smoothly reducing the collective pitch of the main rotor. Maintain the hovering height by use of the collective pitch-throttle control lever.

For transition from hovering to vertical descent, displace the collective pitch-throttle control lever to reduce the collective pitch of the main rotor so that the rate of descent does not exceed 0.2 m/sec.

In transition from hovering to the level flight at the same height, apply forward control stick pressure to accelerate the helicopter and simultaneously manipulate the collective pitch-throttle control lever to maintain the height constant. Upon reaching the required speed, stop accelerating the helicopter by applying backward control stick pressure. Suppress the tendency of the helicopter to turn and drift by coordinated movements of the control stick and foot control pedals.

For transition from the level flight to the hovering state, smoothly displace the collective pitch-throttle control lever to reduce the collective pitch of the main rotor. Simultaneously, operate the control stick to reduce the speed of flight.

For transition from the level flight to the gliding, reduce the collective pitch of the main rotor to obtain the required speed of gliding. Keep an eye on the tachometer to be sure that the rpm of the main rotor are within the permissible limits. Adjust the main rotor rpm, if necessary, by turning the twist grip.

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For transition from the power gliding to the level flight, manipulate the collective pitch-throttle control lever to set the engine rating required for the level flight. Maintain the specified speed by operating the control stick.

To transit from gliding to hovering near the ground, gently apply backward control stick pressure to reduce the speed of flight.

At a speed of 50 - 60 km/hr increase the collective pitch of the main rotor to prevent helicopter "sinking".

When accelerating or decelerating the helicopter, be quick to pass the zone of indicated airspeeds from 20 to 40 km/hr characterized by helicopter excessive vibrations. Ultimate attention should be displayed by the pilot when flying at these airspeeds.

Before starting hovering, turn the twist grip fully clockwise. After accomplishing hovering, trim the controls.

Helicopter Descent

Power Gliding

Power gliding is the basic type of helicopter descent.

To enter into gliding proceed as follows:

- set the speed required for gliding;
- set the collective pitch of the main rotor so as to ensure the required vertical speed of descent.

Depending upon the altitude, the following indicated gliding airspeeds are recommended:

H, m	Range of indicated airspeeds for gliding, km/hr		Vertical speed of descent, m/sec
	recommended	permissible	
1	2	3	4
4500 - 4000	110 - 130	110 - 145	Not over 4
4000 - 3000	110 - 140	110 - 160	Same
3000 - 2000	120 - 160	110 - 190	Not over 7

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1	2	3	4
2000 - 1000	120 - 160	100 - 230	Not over 7
1000 - 0	120 - 160	100 - 250	Same

In gliding, the main rotor rpm are to be maintained within the limits specified in "Level Flight" section.

Helicopter Power-Off Descent

(With Autorotating Main Rotor)

In transition to descent with the autorotating main rotor, decrease the collective pitch of the main rotor to 1° as checked against the indicator and turn the wing to the lower angle of attack irrespective of the altitude and helicopter flying weight.

In the course of descent manipulate the collective pitch-throttle control lever to maintain the main rotor rpm within 78 - 83%.

When descent is performed by the unloaded helicopter, the minimum rpm of the main rotor may reach 70%.

It is allowed to glide at autorotation at the indicated airspeeds of 120 - 250 km/hr^{depending on the altitude}. The best speeds for gliding range within 140 and 180 km/hr.

In transition to the main rotor autorotation the helicopter balance is impaired. During autorotation the helicopter displays a tendency to turning, banking to the right, and nose-dropping. Hence, the pilot should displace the control stick to the left and backward to counteract banking and nose-drop and simultaneously displace the left foot control pedal to prevent helicopter turning.

When performing turns or when recovering from gliding, check to see that the rpm of the main rotor do not exceed 87%. The amount of bank in turns should not be over 20°.

In transition from the autorotation to the power flight, decrease the speed to 140 - 160 km/hr to reduce the helicopter unbalance. Gently displace the collective pitch-throttle control lever to increase the engine power to the required

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value. Turn the twist grip to set the main rotor rpm within 78 - 83%. This done, turn the wing into the position required for the level flight.

Helicopter Landing

The helicopter may perform the following kinds of landings:

- power landing with translational speed;
- vertical power landing;
- power-off landing with autorotating main rotor;
- landing on one running engine with translational speed (in cases of emergency).

If it is possible all types of landings are to be performed against the wind.

Helicopter Power Landing With Translational Speed

The landing is to be performed on the airfield or even ground space, provided that safety gliding is possible.

When descending to the height of 40 - 30 m, establish the indicated airspeed of 60 - 70 km/hr. Go on descending at the vertical speed of 0.5 - 1 m/sec. In the course of descent the indicated airspeed should continuously be reduced and at the instant of touch-down it should be 50 - 60 km/hr.

As the helicopter makes landing on two main wheels, immediately decrease the collective pitch of the main rotor to the minimum, turn the twist grip fully counterclockwise, and gently land the helicopter nose wheel. Apply the brakes to reduce landing run.

If progressive vibrations arise after helicopter landing, cut off the engines by the stop cocks or fuel shutoff valves.

WARNING: After the helicopter main wheels touch the ground, the collective pitch should be immediately decreased and the twist grip turned fully counterclockwise. Failure to observe this requirement may result in a rise of rapidly progressing lateral vibrations (ground resonance). In case of ground resonance the engines should be immediately stopped.

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Vertical Power Landing

Gliding should be performed at the airspeeds of 120 - 160 km/hr.

Before landing, transit from gliding to hovering at the height of 2 - 3 m. To this end, at the height of 40 - 50 m reduce the speed to 60 - 70 km/hr by applying slight backward control stick pressure.

In the course of gliding trim the controls.

At the indicated airspeed of 50 - 60 km/hr turn the twist grip to adjust the main rotor rpm to 78 - 83%. Smoothly increase the collective pitch of the main rotor to maintain the specified vertical speed of descent.

The pilot should remember that during final gliding with decrease of the flight speed the main rotor rpm are to be maintained by turning the twist grip.

Accuracy of helicopter descent is to be adjusted by varying the pitch of the main rotor. The speed of flight is to be maintained by respectively displacing the control stick.

Prior to entering into hovering, apply forward control stick pressure and displace the right foot control pedal to counteract the helicopter tendency to sharp hovering with the nose up, to turning, and banking to the left.

In the course of approaching the ground during vertical descent, gradually decrease the vertical speed so that at the moment of touch-down it will equal 0.1 - 0.2 m/sec.

Prevent side displacements of the helicopter before touch-down.

The collective pitch of the main rotor is to be reduced to the minimum provided that the pilot is sure that the helicopter rests by its wheels against hard soil. After touching down, smoothly decrease the pitch of the main rotor to the minimum.

To go around again, increase the collective pitch of the main rotor till its rpm reach 78 - 83%. Apply forward control stick pressure to impart translational speed to the helicopter and enter into climbing.

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Navigator's Duties in Flight

In case of flight over the airfield area, the navigator should do the following:

- in the course of taxiing, observe the front hemisphere and report all the noticed obstacles to the pilot;
- after taxiing to the take-off start line (and during taxiing from the parking site), slave the system of the PNR-1 gyro-induction compass and set the scale of the PNR-52 directional gyro course setter to the magnetic course of take-off;
- report flight readiness to the pilot;
- as the helicopter begins its movement, start the clock to count the time of flight;
- record the time and course of take-off into the log book;
- check to see that the flight is performed in accordance with the flight plan and with due observation of the flight conditions;
- compute the drift angles at straight sections of the rectangular pattern;
- when flying into the advanced training zone or when leaving the zone, follow the instructions of the flight control officer and observe the regulations prescribed in the flying instructions for the given airfield;
- regularly inform the pilot on helicopter position and time of flight in the advanced training zone; check the altitude and speed of flight;
- when putting the helicopter on the landing course, compare the readings of the PNR-52 directional gyro, PNR-1 gyro-induction compass, and APK-5 automatic radio compass (the directional gyro and the gyro-induction compass should indicate the landing course, the pointer of the automatic radio compass should indicate the radio station relative bearing equal to zero); if the helicopter deviates from the landing course, inform the pilot on the necessity to correct it;

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- inform the pilot on the height and time of flying over the outer marker beacon;
- inform the pilot on the speed of gliding and time when flying over the inner marker beacon;
- after flying over the inner marker beacon, observe the front hemisphere and fasten the harness provided it was not fastened during the flight;
- at the end of landing run, record the time of landing and deenergize the automatic radio compass;
- observe the front hemisphere during taxiing;
- after taxiing to the parking site, see that the station is in good order;
- inform the pilot on all the faults in the equipment operation noticed in flight.

When flying on the assigned route the navigator should do the following:

- perform pre-flight preparation in the full scope of the navigator's manual;
- after taking-off, fly the helicopter to the point of departure, mark the time when this point is flown over, and inform the pilot on passing the point of departure; after this, fly the helicopter in compliance with the navigator's flight plan;
- in the course of flight inform the pilot on the calculated and actual time of passing the check-points and time of arrival into the assigned point;
- regularly check the ground speed of the helicopter and inform the pilot on speed variation when the ground speed does not correspond to the engineer and navigator's calculation of full radius flight;
- in visual flight, check the helicopter position and flying conditions;
- in flight on assigned route, when latitude is changed by more than 2° , introduce a correction for latitude on the control panel of the PNR-52 directional gyro. When flight endurance exceeds 2 hours, introduce corrections to the readings of the course setter;

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- when flying in clouds, carry out dead reckoning and fly the helicopter into the initial point for starting landing approach. Set the barometric altimeter at the pressure corresponding to the pressure of the airfield of landing.

See Appendix No 2

Radio-Operator's Duties in Flight

Report flight readiness. In the course of taxiing and flight observe flying conditions from the station and report all noticed obstacles to the pilot.

When flying in the airfield area, record all radio messages transmitted and received by the pilot into the radio log book. Request clearance from the pilot to begin carrying out the task on radio communication.

When the V.H.F. command radio set is malfunctioning, be ready to establish H.F. command radio communication through the 1-PCB-70 radio set. When the radio communication equipment or interphone system is faulty, inform the pilot and take measures to eliminate the fault.

When flying on assigned route establish radio contact in accordance with the communication plan and instructions of the pilot. Always bear it in mind that the helicopter flies at comparatively low altitudes which requires thorough preliminary preparation (selection of frequencies), accurate and quick operation, strict observance of time of operation at the selected frequencies.

After the flight is over, switch off the radio sets and the interphone system in accordance with the pilot's order. Inform the pilot on all the faults and characteristic features of the radio communication equipment operation noticed in the flight.

Flights with Loads Attached to Sling System

Cargo Operator's Duties in Flight

with Externally Attached Cargoes

When carrying cargo on the sling system one member of the crew should be stationed in the cargo compartment behind the guard to perform the functions of the cargo operator.

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The cargo operator should do the following:

- adjust the pilot's actions via the interphone system when hovering over the cargo or releasing it;
- lower to the ground the main wire rope and sling system to attach the cargo;
- control the MHT-3 winch during wire rope release and during heaving up the main wire rope of the sling system and attaching it to the lock;
- when electric and hydraulic cargo release systems fail, quickly release the cargo (by the pilot's command) by manually opening the sling system lock.

When flying with externally attached cargoes, the following limitations are to be observed:

- maximum all-up weight of the helicopter should not exceed 37,500 kg (including the weight of the externally attached cargo);
- maximum permissible weight of the externally attached cargo should not exceed 8000 kg;
- maximum speed of flight with externally attached cargo should be 200 km/hr;
- wind velocity should not exceed 10 m/sec;
- helicopter vertical speed at the moment of cargo lifting off the ground should not be over 1 m/sec.

Pre-Flight Inspection and Check-Up of Sling System
by Cargo Operator

1. Make sure that the limiting ring is mounted in the lower hatch of the fuselage.
2. Inspect the attachment units of the sling system.
3. Check the attachment of the guard and attachment of the cargo hatch doors in the open position.
4. Check arrangement of the winch wire rope on the pulleys and make sure that the engaging lock is properly secured to the wire rope.
5. Make sure that the thumb-piece hydraulic valve on the hydraulic panel is closed.

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6. Check proper rotation of the swivel lock by hand.
7. Make sure that the spring-hooks of the main wire rope and sling system properly operate.
8. Checking the operation of the sling system under voltage should be performed with the ground power supplies connected to the helicopter.
9. Switch on the circuit breaker of the sling system mounted on the pilots' upper panel. In so doing, two white warning lamps (one on the pilots' instrument panel, the other on the sling system junction box in the cargo compartment) will come on to indicate that the hydraulic lock of the sling system is opened.

Prior to energizing the MHP-3 electric winch, check the position of the rod of the lock actuating cylinder to be sure that the sling system lock is opened (with the lock opened, the cylinder rod should be in the retracted position).

If the sling system hydraulic lock happens to be closed (after switching on the sling system circuit breaker the green warning lamp will come on the pilots' instrument panel), actuate the electric pump to build up the pressure at least 40 kg/cm^2 in the auxiliary hydraulic system and depress one of the cargo release buttons provided on the collective pitch-throttle control lever to open the hydraulic lock.

10. Release the wire rope of the MHP-3 winch to the required length and connect it with the shoe of the main wire rope by means of the engaging lock.

11. Make sure that the sling system lock is opened and pressure in the auxiliary hydraulic system amounts at least to 40 kg/cm^2 . Actuate the electric winch for heaving up the wire rope. The winch will draw the shoe of the main wire rope into the swivel lock of the sling system. In so doing, the engaging lock will depress the limit switch. The latter will apply current impulse to switch off the winch and to actuate hydraulic valve PA-21M/9 which, in its turn, will open the way for the hydraulic fluid into the actuating cylinder to close the lock of the sling system. At the end of its stroke, the rod of the actuating cylinder depresses the other limit switch which gives a current impulse to warn

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the pilot that the sling system lock is closed (the green lamp will burn on the pilots' instrument panel).

12. Check the operation of the cargo release circuit. To this end, depress the cargo release button arranged on the collective pitch-throttle control lever. In so doing the main wire rope should drop out of the lock (the white warning lamps will burn on the pilots' instrument panel and on the sling system junction box).

13. Check the operation of the duplicating cargo release circuit. To this end, proceed as specified in Items 10 and 11 and then depress the button of cargo emergency release arranged on the collective pitch-throttle control lever. In so doing, the main wire rope should drop out of the lock and the white warning lamps will get burning on the pilots' instrument panel and on the sling system junction box.

14. Check the operation of the cargo manual release control system (to be employed if the electric control system and auxiliary hydraulic system fail). Repeat all the steps specified in Items 10 and 11. Release the pressure from the auxiliary hydraulic system. For this purpose, open the thumb-piece hydraulic valve mounted on the hydraulic panel by turning the handle down, shift the cargo emergency release handle down to drop the main wire rope of the sling system and then close the thumb-piece valve. The cargo emergency release handle will come back to its position as the lock is closed.

15. Check the condition of the safety belt and fit it to size.

16. Inform the pilot on readiness of the sling system for operation.

WARNINGS: 1. To prevent damage to the limit switch, heave up the wire rope by the JMT-3 winch actuating only one winch motor.
2. After heaving up the wire rope and closing the sling system lock (the green warning lamp is burning), slacken the wire rope of the winch applying a short current impulse for wire rope release.

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Attachment (Detachment) of Cargo
and Flight with Externally Attached Cargo

Flying the MH-6 helicopter with externally attached cargo, attachment of cargo at hovering, take-off of the helicopter with cargo, estimation for gliding to the site where the cargo is to be detached, are rather peculiar tasks and require the pilots to have certain habits.

Depending upon the ground surface conditions, the cargo may be attached to the sling system in two ways:

- first way involves helicopter landing near the cargo;
- second way involves attachment of cargo during hovering when helicopter landing near the cargo is not possible.

For training the crew members to handle the cargo on the sling system, a special site is prepared on the airfield. The cargo is arranged on the squared ground space, 25x25 m, the angles of the space being marked with flags or chalked strips 0.5 m wide.

Begin training the crew members with the cargo of up to 2000 kg. In the course of experience accumulation increase the weight of the cargo to the maximum.

The flight control officer should be in the field of vision of the pilot at a distance of 50 - 100 m from the space where the cargo is to be attached (detached) and at an angle of 90° to the line of take-off.

Guiding the helicopter to the cargo should be accomplished by the crew members via the interphone system in the following way. First, the helicopter is guided to the cargo by the navigator. As the helicopter is hovering over the cargo, the cargo operator assumes the control. The commands should be as short as possible ("2 meters to the right", "1 meter to the left", "Down", "Up", "Stop").

The flight control officer interferes with the helicopter control only when a danger is arising (the tail rotor is near to the obstacle, very low height of flight, and the like).

When the cargo has been attached and particularly when gliding to the ground space where the cargo is to be detached,

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the flight control officer should inform the pilot on the height of the cargo over the ground ("Height 30 m", "Height 10 m", etc.).

Successful performance of the mission depends on the rate of harmony that will be achieved in work of the inboard cargo operator, flight control officer and pilot.

Before carrying out the flight with cargo attached to the sling system, the pilot should do the following:

- obtain information from the inboard cargo operator on condition of the sling system;
- check the operation of the cargo release buttons.

Prior to take-off the pilot should obtain information from all the crew members on flight readiness, request via the radio set a clearance for take-off and attachment of the cargo.

When lifting the externally attached cargoes of small dimensions and symmetrical shape, the helicopter displays the best stability at the speed of 140 - 150 km/hr.

The symmetrical cargoes of large dimensions (like the bridge beam, 25 m long) are turned during the flight across the direction of flight and produce extensive drag. As the speed of flight exceeds 110 km/hr, the main wire rope touches against the limiting ring. Further increase of the speed is not allowed.

The symmetrical cargoes of great height and small bottom area (like the railway containers) begin rotating with increase of flight speed. The rotation of cargo has no effect upon the helicopter behaviour. The flight is to be performed at a speed of 120 - 130 km/hr.

First Method of Cargo Attachment

(with Helicopter Landing)

1. Make landing at the ground space near the cargo (at a distance of 10 - 20 m) and shift the engines to slow running. To facilitate take-off and approach to the cargo it is better to land the helicopter so as to have the cargo at the port side.

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2. Connect the spring hooks of the sling system to the load-carrying units mounted on the cargo.

3. The cargo operator should release the wire rope of the JNH-3 winch (through the cargo hatch) and the ground personnel should connect the engaging lock to the shoe of the sling system main wire rope.

To ensure trouble-free operation of the JNH-3 winch during the wire rope release, tighten the wire rope by hand.

The winch wire rope is to be arranged on the ground in coils which will provide for the required displacements of the helicopter after taking-off without causing the danger of the engaging lock disconnection.

4. The pilot should inquire all the crew members on the flight readiness, and request via the radio the clearance for take-off and attachment of the cargo.

5. After obtaining the clearance hover near the cargo (the cargo should be in front of and to the left from the helicopter).

In hovering, make the helicopter steady and trim the control stick. Make sure that there is a margin of right foot control pedal deflection and a margin of 20 - 30° for fuel lever position indicator.

6. Displace the helicopter in the direction of the cargo. Select a check-point on the ground and displace the helicopter relative to the selected check-point in accordance with the commands of the cargo operator.

On obtaining the report CARGO ATTACHED from the operator, make sure that the main wire rope is locked (the green warning lamp comes on).

7. Smoothly begin ascending till the main wire rope is tightened up. At proper position of the helicopter relative to the cargo, the helicopter displays stability in hovering over the cargo.

8. After tightening up the wire rope, increase the engine power to the take-off rating. Be always sure that the rpm of the main rotor are constant.

9. To maintain the rpm of the main rotor smoothly increase the rotor pitch by the collective pitch-throttle control lever and simultaneously turn the twist grip fully clockwise.

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10. When hovering is performed at maximum power prevent the helicopter from turning relative to the wind direction. The right side wind causes a decrease of the main rotor speed by 2 - 3% which may bring to inadvertent descent of the helicopter.

11. If the cargo is steady in hovering apply slight forward control stick pressure to bring the helicopter into acceleration.

12. In the course of speed gaining the helicopter rapidly develops an additional thrust. To maintain the main rotor speed turn the twist grip counterclockwise and increase the collective pitch.

13. Speed up the helicopter gradually. When the speed of 70 km/hr is developed obtain information from the inboard operator on the cargo behaviour after each 10 km/hr increment of speed.

In most cases of flights with externally attached cargoes the speed up to 200 km/hr may be developed. However, the speed of flight should not be increased if the main wire rope touches the limiting ring or the cargo is progressively swinging.

14. The descent of the helicopter with the externally attached cargo is to be performed at the vertical speed of 2 - 3 m/sec with gradual decrease of the flight speed.

15. During the helicopter descent the rpm of the main rotor grow; hence, at the beginning of descent the power of the engines is to be increased by increasing the collective pitch, the twist grip being in the intermediate position.

The collective pitch-throttle control lever should be so displaced and the twist grip should be so turned that the rpm of the main rotor are maintained by way of increasing and not decreasing. If the pilot accelerates the main rotor and then starts decreasing the rpm by turning the twist grip, he will have no time to increase the rpm afterwards (due to the low rate of response of the main rotor) and the helicopter will start descending at hovering.

16. When decelerating the helicopter, vibrations arise which are decreased if the instant of hovering coincides with turning the twist grip fully clockwise to increase the rpm.

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In this case the helicopter gains some height prior to hovering and the vibrations are discontinued.

17. The helicopter should start hovering at some distance from the ground space where the cargo is to be landed. After bringing the helicopter into hovering make necessary displacements at a speed of 5 - 10 km/hr.

18. As the helicopter is hovering over the ground space where the cargo is to be landed, perform vertical descent by double displacements (down and up) of the collective pitch-throttle control lever.

19. After the cargo is lowered on the ground, slightly descend, displace the helicopter aside, and depress the cargo release button to disengage the main wire rope (the helicopter should be displaced aside to prevent the cargo from damage while releasing the main wire rope).

20. Check the cargo release against the warning lamps (the green lamp should go out and the white lamp should come on). If the lock is not opened (the green lamp is burning), depress the cargo release button of the duplicating (emergency) system. When the cargo fails to be released from the pilot's station, give command RELEASE CARGO via the interphone system to the cargo operator.

Note: After the cargo is released by emergency system and the control handle of the hydraulic lock is set at the closed position, the hydraulic lock will close provided that the pressure is available in the hydraulic system.

After this the hydraulic lock may be opened by depressing the button of cargo release from the main or duplicating system.

Second Method of Cargo Attachment

(In Hovering)

1. The helicopter makes hovering over the cargo and the cargo operator lowers the sling system main wire rope engaged with the wire rope of the HHP-3 winch. To this end, the cargo operator will engage (in the cargo compartment) the wire rope of the HHP-3 winch with the shoe of the main wire rope and

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will manually release the main wire rope through the cargo hatch; further release of the main wire rope will be effected by means of JHP-3 winch.

2. After engagement of the wire rope system, the ground personnel should retreat to the safety area not to be injured by the cargo or wire ropes of the sling system if they are released by the pilot (in cases of emergency).

To prevent injury to hands, do not adjust the hooks when pulling up the wire ropes of the helicopter sling system in hovering.

3. Further actions of the helicopter crew members and flight control officer during cargo attachment, helicopter take-off, and cargo detachment are the same as in the first case (with helicopter landing).

WARNING: To prevent injury by the static electricity, the ground personnel should not touch the wire ropes until the ropes of the sling system or wire rope of the winch contact with the ground.

Notes: When flying with externally attached cargoes take into account the following:

1. The ground surface condition (dust, snow). Prior to attaching the cargo, the helicopter should hover near the cargo and blow off the dust or snow by the airstream induced by the main rotor. Only when the cargo is clearly seen from the hovering helicopter, perform approach to the cargo and attach the latter.
2. The PB-2 altimeter yields erroneous readings of height (the error in readings may reach 150 m) when flying with large-size cargoes on the sling system. Do not rely upon the altimeter readings at these conditions.
3. Unstable operation of the radio compass.

The cargo transported on the sling system should be immediately released:

- at hovering provided that the maximum power is used, but the helicopter starts descending with turning to the left (the right foot control pedal is fully deflected);
- when the cargo touches the ground during acceleration or deceleration;
- in case of extensive swinging of the cargo which may impair the flight safety;

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- in case of emergency landing;
- in case of one engine failure (provided that the flight can not be continued on one engine).

WARNING: After securing the main wire rope by the hydraulic lock the cargo operator should not bend his head over the guard, for when the cargo is being released, the shoe of the main wire rope springs out of the hydraulic lock aside and may cause injury to the operator.

Peculiar Features of Flying Helicopter under Autopilot Control

Engagement of the autopilot considerably facilitates flying the helicopter with the externally attached cargo.

Prior to engaging the autopilot, check its readiness for operation (yellow warning lamp is burning) and trim the controls.

Engage the autopilot at the stable state of flight. When flying on the assigned route the autopilot reliably maintains the preset conditions of flight.

Disengage the autopilot before descending with externally attached cargo.

Piloting Helicopter by Means of AN-31B Autopilot

The present section includes the instructions concerning the following:

- preflight checking of the AN-31B autopilot by the helicopter crew members;
- piloting the helicopter by means of the AN-31B autopilot.

Autopilot Pre-Flight Inspection

Before Engine Starting.

1. Connect the ground power supply to the helicopter.
2. Connect the ground hydraulic unit to the helicopter inlet connections and build up the pressure of

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120 - 155 kg/cm² in the main hydraulic system. When the ground hydraulic unit is not available, build up the pressure by electric pump 465M whose control switch is mounted on the central instrument panel in the pilots' cabin.

To create rapidly the pressure of 120 - 155 kg/cm², the 465M electric pump should be actuated at the closed 1A-74 valve of the main hydraulic system. To this end, all the time during the pump operation the valve control switch should be placed at OFF position.

WARNING: When the 1A-74 valve is switched on, allow the 465M electric pump to operate for not more than 15 min and then switch it off for 10-min interval.

3. Check the helicopter controls for free displacement by deflecting the control stick and the foot control pedals from one extreme position to the other. Trim the controls to facilitate their displacement.

4. Place the turn control knob of the three-channel handle at the zero position determined by the direction of the arrow in sympathy with the flight and by operation of the retainer.

5. Check the voltage of the helicopter mains. It should equal 27±2 V as measured by the inboard voltmeter.

6. Cut in the AUTOPILOT and GYRO-INDUCTION COMPASS circuit breakers.

7. Cut in the POWER switch on the control panel. After 35 - 150 sec the orange lamp READY will burn on the control panel.

8. Cage the master vertical gyro by depressing the CAGE button for 2 - 3 sec.

Check the recovery of the master vertical gyro HVB-2 against the MASTER VERTICAL GYRO indicator on the control panel.

Before and after depressing the PITCH button on the control panel, the pointer of the indicator should rest near the zero mark and the green lamp of the master vertical gyro on the control panel should burn.

9. Depress the SLAVING button of the gyro-induction compass and release it after the compass is slaved.

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10. Check slaving of the autopilot by quickly and successively deflecting the control stick and foot control pedals.

When the control stick and foot control pedals are rapidly displaced, the lamp READY should go out. When the controls are not moved, the lamp should come on again.

11. Check the operation of the limit-switches of the control stick and foot control pedals for which purpose smoothly and successively deflect the control stick (forward, backward, to the right, to the left) and then the foot control pedals.

At smooth displacement of the control stick and foot control pedals the lamp READY should be on. It will go out only when the limit-switch operates (when the controls are deflected to the limit-switches).

Note: The autopilot limit-switches are so installed that they operate earlier than the controls are deflected till the stop. If the lamp READY goes out earlier than the foot control pedals reach the limit-switch, the operation of the foot control pedal limit-switch is checked by a specific click. This phenomenon is quite normal. It takes place when the ratios of the direction angle are near to their lower limit.

12. Check the serviceability of the autopilot by depressing the autopilot cut-in button. In so doing, the lamp READY should go out and the green lamp CUT-IN should come on.

Apply efforts to the controls to make sure that the autopilot is cut-in (the controls should not displace or may displace only through 10 mm due to the stroke distance of the slide valve).

13. Check disengagement of the autopilot by depressing the cut-off button on the control stick. When the autopilot is disengaged, the green lamp CUT-IN goes out and the orange lamp READY comes on. This means that the controls are released.

Cut-in the autopilot again and check its disengagement from other control buttons (mounted on the control stick of the co-pilot and on the centre control panel).

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14. Check the helicopter control from the three-channel control handle. To this end, cut-in the autopilot and deflect the stick of the three-channel handle successively to the left, to the right, backward, and forward and rotate the turn control knob clockwise and counterclockwise. In so doing, the helicopter controls will be deflected as specified below:

Unit	Direction of deflection	Direction of controls displacement
Three-channel control handle	Diving	Forward control stick pressure
	Climbing	Backward control stick pressure
	Left bank	Left control stick pressure
	Right bank	Right control stick pressure
	Left turn (counterclockwise)	Left foot control pedal forward
	Right turn (clockwise)	Right foot control pedal forward

15. Disengage the autopilot by use of the cut-off button and deenergize the autopilot.

WARNING: When the magnitudes of the ratio by the angle of direction approach the lower limit, the foot control pedals may stop short of the limit-switch and start displacing backward periodically oscillating. In this case the relationship specified in the Table is disturbed. This phenomenon is quite normal. However, it is recommended to check the direction of the pedal movement from the turn control knob in the small range of foot control pedal deflection from their neutral position.

After Starting Engines and Accelerating Main Rotor.

1. Energize the autopilot and switch on the circuit breaker of the gyro-induction compass. Slave the gyro-induction compass and make sure that the warning lamp READY on the control panel has come on.

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After taxiing to the take-off line and slaving the gyro-induction compass, depress the autopilot cut-in button. In so doing, the lamp READY on the control panel will go out and the green lamp CUT-IN will come on.

Apply efforts to the controls to make sure that the autopilot is engaged.

2. Disengage the autopilot by operating the cut-off button on the left control stick. Engage the autopilot again and check its disengagement from other cut-off buttons.

3. Check the control from the three-channel control handle for which purpose engage the autopilot and deflect the stick of the three-channel control handle successively to the left, to the right, forward and backward and rotate the turn control knob clockwise and counterclockwise.

The three-channel control handle should be manipulated through the minimum range so that the pilot would be able to check the control stick and the foot control pedals for proper displacement.

4. Disengage the autopilot.

WARNING: When checking the autopilot on the ground with started engines and accelerated main rotor do not abandon the control stick and the foot control pedals. Immediately disengage the autopilot if it is malfunctioning. On the ground the autopilot may be engaged at the end of 1 min after shifting from the duplicating hydraulic system to the main one. If one of the channels is not hydraulically engaged (the control organ moves without difficulty when an effort is applied), shift the autopilot to the slaving mode of operation and repeat engagement of the autopilot.

Autopilot In-Flight Checking

Perform take-off with the autopilot ready for operation (the POWER switch on the control panel should be on and the warning lamp READY should burn).

Engagement of Autopilot in Flight

The autopilot may be engaged at the straight stable flight (level flight, climbing, gliding).

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Cut-in the autopilot at all the permissible speeds of flight at altitudes not below 100 m.

The maximum altitude at which the autopilot may be engaged is 4000 m.

Before cutting-in the autopilot balance the helicopter at all the axes, trim the controls, and slave the gyro-induction compass.

To engage the autopilot depress the button AUTOPILOT CUT-IN.

WARNING: 1. After the autopilot is engaged the slaving button of the gyro-induction compass is automatically interlocked (fast slaving will not occur when the slaving button is depressed).

If during the flight with the cut-in autopilot a transition is made from the main hydraulic system to the duplicating one, disengage the autopilot by depressing one of the cut-off buttons. In so doing, the green lamp CUT-IN will go out and the orange lamp READY will come on.

2. In flight the autopilot should be always energized. At no circumstances should the autopilot be deenergized in flight as the gyroscopic instruments (HFB-2 master vertical gyro and HVC slip angle transmitter) must always be in the operating condition.

Piloting Helicopter by AH-31B Autopilot

Straight-and-Level Flight

When the autopilot is cut-in at the straight run of the stable state of flight it will automatically maintain the flight conditions.

Small adjustments to the conditions of flight may be performed by the three-channel control handle.

Controlled Flight

The conditions of flight of the helicopter are changed by deflecting the stick and rotating the head (turn control knob) of the three-channel control handle. Simultaneously, the collective pitch-throttle control lever should be respectively deflected by the pilot.

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When the stick of the three-channel control handle is deflected the helicopter roll and pitch angles vary at the rate proportional to the amount of angle through which the stick is deflected.

As the helicopter obtains the required pitch and roll angles the stick of the three-channel handle is to be set at the zero position.

To set the initial magnitude of the roll and pitch angles the stick of the three-channel control handle is to be deflected in the opposite direction.

When the turn control knob is rotated the helicopter starts turning at the rate proportional to that of the turn control knob rotation. To discontinue helicopter turning set the turn control knob to the initial position and fix it.

Normal turns and banked turns are to be performed by respectively deflecting the stick and rotating the turn control knob of the three-channel control handle.

After setting the required amount of bank, the stick is to be brought into the neutral position.

When bringing the helicopter into the turn, the turn control knob should be respectively rotated in the proper direction to ensure the specified rate of turn and angle of slip. The turn control knob should be maintained in this position up to completing the banked turn.

To recover from the turn, set the stick of the three-channel control handle for the opposite bank and place the turn control knob at the retainer.

For rapid recovery from the turn rotate the turn control knob in the opposite direction to pass the neutral position and then bring it back to the retainer.

Autopilot Disengagement

Disengage the autopilot by depressing one of the cut-off buttons. In so doing, the green lamp CUT-IN will go out and the orange lamp READY will come on.

WARNING: 1. When the autopilot is disengaged at the state of flight different from the state of flight during

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engagement of the autopilot, a push of controls caused by the forces of the spring-feel mechanisms may take place.

To prevent a sharp change of the helicopter attitude during autopilot disengagement, the pilot should firmly hold the cyclic-pitch control stick and the foot control pedals. After disengagement of the autopilot he should trim the controls.

2. In all cases when the autopilot is malfunctioning, it should be immediately cut-off.

Stopping and Relighting Engine

Stopping Engine in Flight. Flight and Landing on One Engine

For the training purposes one (any) engine may be stopped:

- in the level flight, during climbing and descending at altitudes of 1000 to 4000 m and at the speeds from 100 km/hr to the maximum permissible speeds for the given altitude;
- at the helicopter flying weight not over the normal all-up weight;
- at any rating of the engine up to the normal rating.

Stopping the engine for the training purposes is to be effected over the airfield.

To stop the engine set the engine stop cock at the CLOSED position by displacing it backward till the stop.

When left or right engine is stopped, the helicopter tends to turn to the right and the rpm of the main rotor sharply decrease.

After stopping the engine, proceed as follows:

- energetically deflect the collective pitch-throttle control lever downward (by 6 - 8 cm) to prevent drop of rpm of the main rotor below 78 % and simultaneously deflect the left foot control pedal by 1/3 - 1/4 of its travel to suppress the helicopter tendency to the right turn;
- smoothly but energetically deflect the engine selector control lever upward to increase the power of the operating engine to the take-off rating and establish the indicated

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speed of flight of 130 - 150 km/hr, which provides for helicopter minimum vertical speed of descent.

The co-pilot should manipulate the collective pitch-throttle control lever to assist the pilot in maintaining the rpm of the main rotor within the operating range (78 - 83 %).

At normal all-up weight, the helicopter flying on one engine at an altitude of 1000 m and flight speed of 130 - 150 km/hr may continue flying without descent when the operating engine runs at combat rating (93° by the fuel lever position indicator) and may perform climbing at vertical speed up to 0.5 m/sec when the engine operates at the take-off rating (97° by the fuel lever position indicator).

The endurance of level flight on one engine with normal all-up weight is limited by the permissible time of continuous operation at the combat or take-off rating. During the flight performed on one engine the increased ratings of the engine operation may be used in the following succession: after 6-min operation at the take-off rating or after 15-min operation at the combat rating allow the engine to run for 5 min at the ratings not over the normal rating and then set the engine at the take-off or combat rating.

Time of operation on one engine should not exceed 10 % of the main gear box service life.

Approach for landing on one engine is performed in the same manner as during landing approach on two running engines.

When gliding for landing, make sure that the engine selector control lever of the running engine is in the uppermost position.

Prior to deceleration, specify estimation for landing and maintain the rpm of the main rotor within 78 and 83 % by use of the collective pitch-throttle control lever and twist grip.

During gliding for landing and deceleration do not move the collective pitch-throttle control lever energetically upward as during increase of the collective pitch the rpm of the main rotor drop much faster than in case with two operating engines.

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During deceleration before landing the twist grip is to be turned fully clockwise.

With one engine operating, only running landing may be performed. At the moment of touch-down the indicated air-speed should be at least 70 km/hr.

Note: When flying on one engine, the fuel is delivered through the cut-off engine into fuel tank group No. IV. For complete consumption of fuel from this fuel tank group actuate the manual fuel consumption control system or, if the fuel consumption was controlled automatically and the fuel of fuel tank group No. IV was consumed prior to engine stopping (fuel tank group No. IV was automatically disconnected), actuate the automatic fuel control system by switching off the AUTOMATIC circuit breaker for a short period of time (for 1 - 2 sec) and switching it on again.

Engine Relighting

There are no limitations by speed, altitude of flight, and rating for relighting the engine.

Prior to relighting the engine, make sure that the power sources yield the voltage of at least 24 V.

Place the engine selector control lever of the cut-off engine at 15 - 18° as measured by the fuel lever position indicator.

In the course of relighting do not displace the collective pitch-throttle control lever and the twist grip to avoid disturbance of the limb position of the engine to be relighted.

Place the engine starting selector at the position of the relighted engine and the function switch STARTING-CRANKING, at the STARTING position.

Start the stop-watch and simultaneously depress the starting button for 1 - 2 sec. As the compressor rotor develops 1000 - 1500 rpm (9 - 14 %), shift the engine stop cock from the CLOSED position into the OPEN position making allowance for the ambient air temperature (See note in the "Engine Starting" section).

The relighting procedure is the same as for starting the engines on the ground.

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With increase of altitude the slow running rpm become greater and at the altitude of 3500 m they comprise 71 - 72 %.

It takes 58 - 70 sec for the engine to develop the slow running rpm.

As the engine gains the slow running rpm, smoothly shift both engine selector control levers to the middle latch and use the collective pitch-throttle control lever and twist grip to set the engines at the required rating.

Number of relightings is not limited. After every five relightings make a 15-min interval to allow the starter to cool.

Night Flying

When carrying out preparation for night flying, perform all the inspections prescribed for day flights and additionally do the following:

- obtain information from the engineer on serviceability of night lighting equipment;
- make sure that the glass of the head light is clean and integral and check the condition of the navigational and blade-tip lights.

Start the engines in the usual procedure. Switch on the ceiling dome-lamps to lighten the cabin during starting.

After starting, switch on the ultraviolet lamps and use dimmer rheostats to adjust the brightness of the instrument illumination.

The crew members should bear it in mind that there are no retainers on the PKM-45 dimmer rheostats which may result in inadvertent switching off of the ultraviolet lamps when their brightness is being reduced. The ultraviolet lamps may be switched on again only at the end of 2 - 3 min which is enough for lamp cooling.

During taxiing, the head lights should be on. Before making a turn and when it is necessary to improve lightening of the ground space in front of the helicopter, shift the switch from the LOWER BEAM position into the UPPER BEAM position.

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The HP-4 landing and taxiing lights provide for performance of take-offs and landings from the airfields and ground spaces equipped with the required light check-points.

Take-off is to be performed with the switched on lights, the switch being set at the UPPER BEAM position. Night take-off of the helicopter is to be performed in the same procedure as during day-time. When the helicopter unsticks, be careful to prevent helicopter side displacements which may be checked by the runway lights or by the ground lightened with the landing lights. The direction of the light beams is to be adjusted at a safety height in hovering.

At night flying, the displacement of the helicopter backward and sideways is not allowed.

Acceleration and climbing to the height of 50 m should be performed more gradually than at day-time flying. After reaching the height of 30 - 50 m, fly the helicopter by taking advantage of the instruments and natural horizon and switch off the landing light.

During night flying the pilot should be ready for instrument flying as the determination of distance to the clouds is difficult and the helicopter may suddenly happen to be in the clouds.

Entering into the clouds should be checked by the light screen of the helicopter navigational lights and by disappearance of ground light check-points.

When the helicopter accidentally gets into the icing zone and ice is built up on the front glass panels and side blisters, switch on one of the CIC-90/360 generators and glass heating system and leave the icing zone.

Tracking and estimation for landing should be performed in the same way as during day-time flying. At an altitude of 50 - 70 m switch on the landing light and adjust the direction of its beam.

The technique of landing is the same as during day-time. The height of the helicopter is to be checked at the first band of the PB-2 altimeter and visually by the lightened ground area and ground light check-points.

When the landing light is on, fly the helicopter observing the pilot's air speed indicator only.

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If the helicopter performs gliding during raining or snowing and the landing lights are turned on at the height of 50 - 70 m, a dense light screen may appear which will impair observation of the ground. In this case turn off the landing lights and check the helicopter position against the ground lightened by the floodlights.

Weight Distribution and Change of Balance
during Fuel Consumption

The weight distribution of the helicopter is given in the Table:

Load description	Load weight, kg	Arm from load CG to main ro- tor axis, m
Pilot	90	+8.60
Co-pilot	90	+8.60
Navigator	90	+9.70
Flight engineer	90	+7.60
Radio-operator	90	+7.60
Oil:		
in engine oil coolers	12	+1.51
in main gear box oil coolers	36	+1.51
in engine oil system	10	+4.64
in main gear box oil system	22	+0.92
in engine oil tanks	45	+6.98
in main gear box	155	0
Fuel:		
in fuel tank No.1	360	+6.49
in fuel tanks Nos 2 and 3	725	+5.08
in fuel tanks Nos 4,5,6	1100	+2.70
in fuel tanks Nos 7 and 8	675	-1.54
in fuel tanks Nos 9 and 10	2090	-3.63
in fuel tank No.11	1365	-2.15
in external fuel tanks	3490	+0.20

Notes: 1. The "+" sign denotes that the load is located in front of the main rotor axis of rotation,

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- the "-" sign means that the load is arranged aft of the main rotor axis of rotation.
2. The payload should be arranged in compliance with the marks on the sides of the cargo compartment.
 3. The CG position of the empty helicopter is 321 $\pm$ 15 mm aft of the main rotor axis of rotation.

Given below is the chart showing change of the helicopter balance in the course of fuel consumption or in case of incomplete fuelling of the helicopter.

The chart specifies the following data:

- A - helicopter without payload with topped up main and external fuel tanks;
- B - helicopter without payload with topped up main fuel tanks;
- C - helicopter with payload accommodated in frontmost position (as pointed by the blue arrow);
- D - helicopter with payload accommodated in the rearmost position (as pointed by the yellow arrow).

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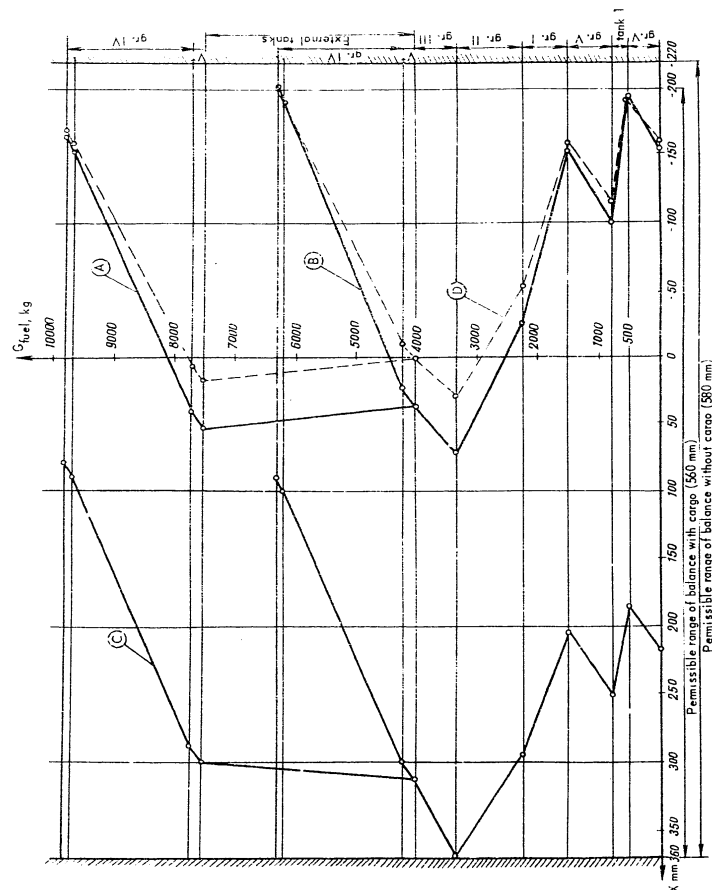


FIG. 3. CHART OF CHANGE OF HELICOPTER BALANCE DURING FUEL CONSUMPTION

* If fuel tank gr. V is tapped up, about 200 kg of fuel is to be consumed from this tank group before opening of the float valve.

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Chapter III

CRITICAL STATES OF FLIGHT

Failure of One Engine

If one of the engines fails in flight proceed as follows:

- reduce the collective pitch to prevent drop of the main rotor rpm below 78 %;
- shift the engine selector control lever of the operating engine into the uppermost position and set the required rpm of the main rotor by use of the collective pitch-throttle control lever and twist grip;
- to prevent fire discontinue fuel supply to the hot failed engine by closing the stop cock of this engine and giving the command to the flight engineer to close the shutoff valve of the failed engine;
- establish the indicated speed of flight of 130 - 150 km/hr and proceed flying in compliance with "Stopping Engine in Flight. Flight and Landing on One Engine" section.

At maximum all-up weight the helicopter may perform flight only with descent even if the operating engine runs at maximum power. At an altitude of 1000 m the speed of vertical descent amounts to 1.5 - 2 m/sec.

Flying on one engine should be performed only to the ground space at which a safety landing may be accomplished.

Only running landing is to be carried out.

Failure of Both Engines

If both engines of the helicopter fail in flight, immediately put the helicopter to autorotation, proceeding as follows:

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- reduce the collective pitch of the main rotor to 1° as measured by the indicator irrespective of the flight altitude and helicopter flying weight. In the course of descending maintain the speed of the main rotor within 78 - 83 % by use of the collective pitch-throttle control lever;

WARNING: The pilot should remember that the main rotor speed depends to a greater extent on helicopter flying weight than on the speed and altitude of flight. The main rotor rpm vary directly with the flying weight; at low flying weight the speed of the main rotor may drop to 70 %.

- give a command to the flight engineer to close the fuel shutoff valves;

- adjust the wing to the incidence angle of 5° ;

- establish the following gliding speed depending upon the altitude of flight:

at an altitude of 4500 to 4000 m - 120 km/hr;

at an altitude of 4000 to 3000 m - 130 km/hr;

at an altitude of 3000 m to sea level - 140 - 160 km/hr.

Procedure of landing is as follows:

- maintain the gliding speed of 140 km/hr;

- at a height of about 25 - 35 m pull the control stick backward to start flareout;

- at a height of 15 - 25 m start increasing the collective pitch of the main rotor so that at the moment of touch-down the collective pitch will be near to the maximum value;

Note: The best increase of the main rotor collective pitch equals 10° as measured by the indicator.

- along with increasing the main rotor collective pitch, apply forward control stick pressure so that at a height of 1 - 2 m the helicopter will acquire landing angle; when strictly observing all the instructions, the helicopter will make landing on two main wheels with subsequent lowering of the nose wheel. The touch-down indicated speed will be equal to 80 - 100 km/hr;

- as the helicopter touches the ground, immediately decrease (for a time of 1.5 - 2 sec) the main rotor collective pitch to the minimum to prevent a sharp drop of the main rotor speed;

- apply the brakes in the second half of landing run at a speed not over 50 km/hr.

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Fire in Flight

The fire in the helicopter may be detected by:

- burning of the light panel FIRE mounted on the pilots' instrument panel and burning of one of the fire warning lamps mounted on the control panel of the fire fighting system;
- appearance of smoke or smell of burning in the cabins;
- excessive rise of turbine outlet gas temperature (this is an additional indication to the fire in the engine compartment).

In case of fire indications locate the fire by the warning lamp mounted on the control panel of the fire fighting system or visually.

In case of fire in the engine compartment proceed as follows:

- stop the engine by the stop cock (pilot's duty);
- close the fuel shutoff valve of the engine (flight engineer's duty);
- make sure that the air blow-off bands of the critical engine are closed (the green warning lamp should go out). If the air blow-off bands are not closed close them by use of the switch;
- depress the FIRE SIGNAL OUT button. If the fire warning lamp goes on burning immediately depress the electric button to actuate the SECOND SHOT;
- discontinue the mission and make landing.

WARNING: Never relight the engine after fighting the fire in the engine compartment.

In case of fire in the main gear box compartment or in the compartments of fuel tanks of groups Nos IV and V (tanks Nos 9, 10 and 11) proceed as follows:

- if the fire warning lamp goes on burning after discharging automatic shot of fire fighting bottles, the flight engineer should depress the MANUAL SHOT OF BOTTLES electric button;
- the pilot should discontinue the mission and make landing.

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If after operation of all the fire fighting bottles the fire goes on spreading the pilot should estimate the situation and decide whether the helicopter will make an immediate landing or the crew members will abandon the helicopter.

When fire is detected but the fire warning system failed to operate (warning lamps and light panel did not come on), the flight engineer should depress the button for manual opening of the valve in the compartment where the fire is detected. In so doing, the lamps of valve opening and automatic shot of bottles will come on.

The discharge of the fire fighting fluid from the bottles of manual shot into this compartment will be performed by depressing the electric button MANUAL SHOT OF BOTTLES. As the bottle operates, four yellow warning lamps will come on.

If the fire is extinguished by automatically operated bottles but another fire is detected in some other compartment, the flight engineer should close the fire fighting valve of the compartment wherein the fire has been extinguished and only after that he should actuate the MANUAL SHOT OF BOTTLES. To this end, switch B-45 is to be placed first at the OFF, and then at the ON position, after which the electric button MANUAL SHOT OF BOTTLES is to be depressed.

Fire in the cargo compartment or in the crew cabin is to be extinguished by means of hand-operated portable fire extinguishers.

When electric wires get burning deenergize the affected circuit, use available fire fighting equipment, and make landing on the selected ground space.

When fuel gets inflamed because of fuel lines damage disengage the fuel booster pumps, close the fuel shutoff valves, use available fire fighting equipment, put the helicopter to the autorotation state and make landing.

When fire fails to be extinguished the crew members should abandon the helicopter.

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Failure of Main Hydraulic System

If the main hydraulic system fails in flight (pressure drops in the system) the hydraulic boosters will be automatically shifted under the control of the duplicating hydraulic system. In this case the green warning lamp of the main hydraulic system will go out on the pilots' instrument panel and light panels SWITCH OFF MAIN HYDRAULIC SYSTEM and DUPLICATING HYDRAULIC SYSTEM ON will come on.

The pilot should place the MAIN HYDRAULIC SYSTEM switch at the OFF position. Discontinue the mission and make landing.

Exceeding Maximum Permissible Speed

When the helicopter speed inadvertently exceeds the maximum permissible value, particularly at the main rotor rpm below the recommended ones, progressive vibrations of the helicopter are observed and the helicopter controllability is impaired. The helicopter starts climbing, banking, and swinging. It proves that the air stream is stalled off the main rotor blades. In this case gradually decrease the collective pitch of the main rotor, establish the main rotor speed recommended for the given height, and reduce the flight speed to the assigned value by applying backward control stick pressure.

Ground Resonance

Ground resonance consists in arising of self-excited rapidly progressing vibrations of the helicopter on the ground.

This phenomenon is completely obviated since the helicopter structure includes two-chamber shock struts of the main legs and special hydraulic spring damper connected with the high-pressure chambers of both shock struts of the landing gear main legs.

However, if this system is malfunctioning or its parameters are other than rated ones, self-excited vibrations may occur especially during engine starting and acceleration of the main rotor at taxiing, as well as during running or vertical take-off and landing. In case of ground resonance the

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pilot should energetically shift the collective pitch-throttle control lever downwards and simultaneously turn the twist grip fully counterclockwise. If the vibrations are not suppressed, the engines are to be stopped.

The translational speed of the helicopter at landing run and taxiing is to be reduced by deflecting the control stick backward and applying the landing gear brakes.

Faults of Gear Boxes

When the gear boxes (main, intermediate or tail gear box) are faulty which may be detected by drop of oil pressure and rapid rise of its temperature, immediately bring the helicopter into gliding at low power and make landing on the selected ground site.

Depending upon the conditions, power landing, vertical landing or running landing may be performed.

If one of the warning lamps of the QC-23 filter comes on in flight, the flight engineer should immediately inform the pilot about it. In this case the pilot should proceed as follows:

- stop the engine whose transmission oil system is affected;
- keep on flying on one engine, select the proper ground space and make landing, following the recommendations prescribed in the section "FAILURE OF ONE ENGINE".

When both warning lamps of the QC-23 filter come on in flight, the flight engineer should inform the pilot who will stop both engines and make landing following the recommendations prescribed in the section "FAILURE OF BOTH ENGINES"

Drop of Oil Pressure in Free Turbines

Drop of the oil pressure in the free turbines below the rated value may result in poor lubrication of the turbine bearings and bring to turbine destruction. Hence, when the oil pressure in the free turbine drops below the rated value, the pilot should stop the engine and make landing. In case of fire indications the fire fighting system should be actuated.

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Power Plant Surge

Surge of the engines on the ground is characterized by rapid rise of gas temperature over 630°C , peculiar pops and noise in the engines and drop of compressor rpm. The throttle should be always advanced gradually which will exclude the possibility of surge.

To avoid surging observe the following recommendations:

- on the ground, with the collective pitch-throttle control lever at 1^o position as measured by the indicator, first turn the twist grip fully clockwise during 2 - 3 sec and when the main rotor speed equals 78 % raise the collective pitch-throttle control lever;
- in flight, when the main rotor speed is within the limits of 70% (at autorotation) to 87 %, and the engine power is to be increased, constantly check the main rotor rpm and manipulate the collective pitch-throttle control lever and twist grip in such a succession and with such a rate of displacement as to ensure gradual change of the main rotor speed to the rated value;
- perform turns in taxiing only after the main rotor develops the speed of 78 - 83 %;
- avoid running the engines at the ratings at which the air blow-off bands operate. When flying under low temperature conditions, at reduced weight of the helicopter, or during gliding, vary the conditions of flight so that the air blow-off bands are in the closed or open position.

In case of surge, the engine is to be immediately stopped.

Escaping Procedure

To ensure reliable jettisoning of doors for escaping from the helicopter, door emergency jettison mechanism is employed on the helicopter. When the door jettison handle is pulled out, squibs explode, and operating rods of the door jettison guns actuate to push out the door.

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To escape from the helicopter, proceed as follows:

- jettison the door;
- turn towards the door side and fix your foot (the right foot when escaping from the helicopter through the right door and the left foot when escaping from the helicopter through the left door) in the rear corner of the door threshold;
- raise your body and bear with the other foot against the seat pan (or other stiff item);
- take hold of the door-way side edges;
- bend your head not to strike against the door-way upper edge;
- by a sharp push of your hands and feet separate from the helicopter. If a height permits the normal opening of the chute, wait for 3 - 5 sec to fly a safety distance off the helicopter and release the chute.

Note. Each crew member escapes from the helicopter through his own emergency door. The radio-operator escapes from the helicopter through the emergency door of the flight engineer. The pilot is the last to escape from the helicopter.

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The "Operating and Piloting Instructions" contain the required information on servicing and flying the Mu-6 helicopter with honeycomb-filled rectangular blades.

When the Mu-6 helicopter main rotor is equipped with trapezoidal blades, the same Instructions are to be followed with due regard to the differences outlined in the present Supplement.

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I. HELICOPTER OPERATIONAL LIMITATIONS

Limitations By Performance Data
and Maneuverability

The maximum permissible altitude of flight of the helicopter with normal all-up weight equals 4500 m and with maximum all-up weight 1500 m.

The level flight with normal all-up weight may be performed within the following range of indicated airspeeds:

Height of flight, m	Maximum permissible indicated speed, km/hr	Minimum permissible indicated speed, km/hr
50	265	80
500	260	80
1000	250	80
2000	235	80
3000	190	90
4000	140	90
4500	120	90

The level flight with maximum all-up weight may be performed within the following range of indicated airspeeds:

Height of flight, m	Maximum permissible indicated speed, km/hr	Minimum permissible indicated speed, km/hr
50	160	100
1000	160	100
1500	160	100

The indicated airspeeds in the durable flight should not exceed the following values:

Height of flight, m	Indicated speed, km/hr	
	with normal all-up weight	with maximum all-up weight
1	2	3
50	200	160
1000	200	160

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1	2	3
1500	200	160
2000	200	-
3000	190	-
4000	140	-
4500	120	-

The tolerated revolutions of the main rotor (%) when flying with normal or maximum all-up weight depending upon the height of flight at all ratings are as follows:

Height of flight, m	Main rotor revolutions, %, (as read off indicator)		
	minimum permissible	recommended	maximum permissible
0	78	83 $\pm$ 1	87, for not over 5 min
1000	78	83 $\pm$ 1	87, for not over 5 min
2000	80	83 $\pm$ 1	87, for not over 5 min
3000	82	83 $\pm$ 1	87, for not over 60 min
4000	83	84 $\pm$ 1	87, for not over 60 min
4500	84	85 $\pm$ 1	87, for not over 60 min

With maximum all-up weight of the helicopter the turns and banked turns may be performed with the bank not over 15° at the indicated airspeeds within 100 to 160 km/hr.

Depending upon the height of flight, the power gliding with normal all-up weight may be performed at the following airspeeds:

Height of flight, m	Permissible range of indicated airspeeds during gliding, km/hr	Vertical speed of descent, m/sec
4500 - 4000	90 - 110	Not over 4
4000 - 3000	90 - 130	Not over 4
3000 - 2000	90 - 190	Not over 7
2000 - 1000	90 - 200	Not over 7
1000 - 0	90 - 200	Not over 7

The power gliding of the helicopter with all-up weight exceeding the normal one from the height of 1500 m to the ground may be performed at the indicated airspeeds within 120 to 160 km/hr, the vertical speed of descent being not over 7 m/sec.

Helicopter gliding with the main rotor autorotating may be performed at the indicated airspeeds within 120 to 200 km/hr. Turns at autorotation should be performed with the bank not over 20°.

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Flying In Adverse Weather Conditions

Flights in clouds are to be performed at heights not over 3000 m at the following indicated airspeeds:

Height of flight, m	Indicated speed, km/hr	
	with normal all-up weight	with maximum all-up weight
up to 1500	140 - 200	140 - 160
from 1500 to 3000	140 - 180	-

II. LEVEL FLIGHT

The level flight with normal all-up weight may be performed at the following indicated airspeeds:

Height of flight, m	Maximum indicated speed, km/hr	Minimum indicated speed, km/hr	Main rotor revolutions, $\%$ (read off indicator)		
			recommended	minimum permissible	maximum permissible
0	265	0	83 ± 1	78	87, not over 5 min
500	260	80	83 ± 1	78	87, not over 5 min
1000	250	80	83 ± 1	78	87, not over 5 min
2000	235	80	83 ± 1	80	87, not over 5 min
3000	190	90	83 ± 1	82	87, not over 60 min
4000	140	90	84 ± 1	83	87, not over 60 min
4500	120	90	85 ± 1	84	87, not over 60 min

Durable flights are to be performed at the indicated airspeed of 200 km/hr at height up to 3000 m and at maximum permissible airspeed at higher altitudes.

The flight for range with maximum all-up weight is to be performed at heights up to 1500 m and at the indicated airspeed of 160 km/hr.

Banked turns with normal all-up weight should be performed with the bank up to 30° at speeds from 80 to 250 km/hr.

III. HELICOPTER DESCENT

Power Gliding

Depending upon the height of flight, the power gliding is to be performed at the following indicated airspeeds:

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Height of flight, m	Permissible range of speeds during gliding, km/hr	Vertical speed of descent, m/sec
4500 - 4000	90 - 110	Not over 4
4000 - 3000	90 - 130	Not over 4
3000 - 2000	90 - 150	Not over 7
2000 - 1000	90 - 200	Not over 7
1000 - 0	90 - 200	Not over 7

Gliding at Autorotation

Gliding with the main rotor autorotating may be performed within the range of indicated airspeeds from 100 to 200 km/hr. The best indicated speeds for gliding are 160 - 180 km/hr.

IV. USE OF INERT GAS SYSTEM

The inert gas system is intended to prevent explosion of the main fuel tanks hit with splinters, bullets or projectiles. This system is to be switched on after taking-off when the helicopter is going to fly into an area where it may be attacked by the enemy.

To actuate the inert gas system, the flight engineer should depress (upon obtaining the pilot order) push-button switch INERT GAS (НЕИЗПАРИВНИ ПАГ) mounted on the flight engineer's left panel.

After the flight in which the inert gas system was employed, the inert gas bottles are to be replaced with charged ones irrespective of the flight duration.

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APPENDIX No.1

CALCULATION OF RANGE OF FLIGHT
(for helicopters with rectangular and trapezoidal blades)

The practical range of flight is determined by the formula:

$$L = \frac{G_{l.f. \text{ fuel}}}{Q_{\text{aver.}}} + \Delta L,$$

where: $G_{l.f. \text{ fuel}}$ - amount of fuel required for level flight;
 $Q_{\text{aver.}}$ - average fuel consumption per kilometre;
 ΔL - distance covered by the helicopter during climbing and gliding.

To determine the amount of fuel required for the level flight, subtract from the total reserve of fuel:

- (a) amount of fuel required for starting and taxiing (120 kg);
- (b) amount of fuel required for test hovering and climbing;
- (c) amount of fuel required for gliding and landing;
- (d) unusable fuel (45 kg including 15 kg in external tanks);
- (e) 5% fuel reserve.

Table for Calculation of Helicopter Range of Flight

Height of flight, m	Fuel consumption, kg		Distance covered, km		Fuel consumption per km and cruising speed			
	for test hovering and climbing	for gliding and landing	during climbing	during gliding	rectangular blades		trapezoidal blades	
					kg/km	km/hr	kg/km	km/hr
1000	200	150	8	10	8.95	250	9.9	200
2000	350	225	16	15	8.7	230	9.25	200
3000	510	290	26	20	8.5	205	9.65	190

Given below is an example of flight range calculation.

Determine the practical range of flight of the helicopter with rectangular blades at $H = 2000$ m with fuel reserve of 4000 kg.

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1. First, determine the amount of fuel consumed during transition states of flight, 5% fuel reserve, and the like.

120 kg of fuel consumed during starting and taxiing are not to be subtracted from the total amount of fuel provided that the fuel tanks are not topped up as this quantity of fuel may be filled up additionally so that at the moment of unsticking the total amount of fuel will equal 4000 kg.

As it follows from the Table, 350 kg of fuel are consumed during test hovering and climbing and 225 kg, during gliding and landing. The distance covered by the helicopter during climbing and gliding equals $16 + 15 = 31$ km.

The 5% ^{guaranteed} fuel reserve is calculated for the topped-up main fuel tanks and equals 315 kg. The unusable fuel amounts to 30 kg provided that only the main fuel tanks are filled up.

2. The fuel remained for the level flight amounts to 3080 kg. As it follows from the Table, at a height of 2000 m the average fuel consumption per kilometre for the helicopter with rectangular blades equals 8.7 kg/km. Hence, the distance covered during the level flight is: $3080 : 8.7 = 354$ km.

3. Summing up the obtained value and the distance covered during climbing and gliding, we obtain the practical range of flight: $354 + 31 = 385$ km.

4. The range of flight of the helicopter with trapezoidal blades is calculated in the same way, but the tabular values of fuel consumption per kilometre and cruising speed are to be taken for the trapezoidal blades.

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$$\Delta = \dots \dots \dots \varphi (\dots \dots \dots)$$

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OF THE UNITED STATES WITHIN THE MEANING OF
THE ESPIONAGE LAWS, TITLE 18, U.S.C. SECTIONS 793
AND 794. ITS TRANSMISSION OR THE REVELATION OF
ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED
PERSON IS PROHIBITED BY LAW.

Ми-6 HELICOPTER powered by Д-25В turbo-rotor engines (c)

BOOK III

OPERATING AND MAINTENANCE
INSTRUCTIONS

LOADING INSTRUCTIONS

HELICOPTER ARMAMENT
DESCRIPTION AND OPERATING INSTRUCTIONS

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Signs ② (number in circle) marked in this book
refer to step number of "ALTERATION" section.

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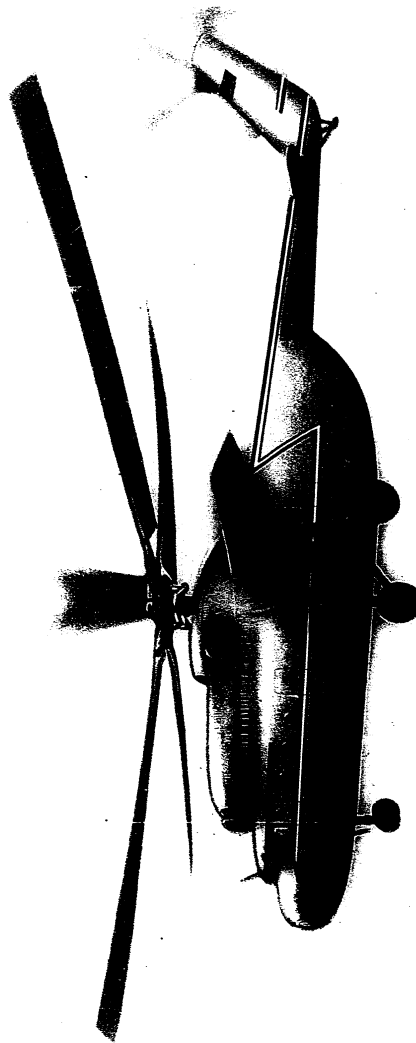


Fig. 1. Helicopter Mi-6. General View

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**HELICOPTER OPERATING AND MAINTENANCE
INSTRUCTIONS**

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The **Mu-6** transport helicopter (Figs 1, 2, 3, 4) designed by M.I. Mil is a single main rotor machine. The torque of the main rotor is counter-balanced by the thrust of the tail rotor.

The helicopter is powered by two **D-25B** free-turbine turbo-rotor engines.

To unload the main rotor, the helicopter is provided with a controllable wing which may be fixed in any of the two positions depending on the flight conditions.

The **Mu-6** helicopter is intended for transportation of passengers, various equipment and loads and can land on unprepared grounds of a limited size.

To pick up and carry bulky loads outside the cargo compartment, the helicopter is provided with an external sling system.

The flight and navigation instruments of the **Mu-6** helicopter provide for flying round the clock in unfavourable weather conditions.

The five-men crew of the helicopter consists of a pilot, co-pilot, navigator, flight engineer and a radio operator. The communication between the members of the crew is effected through a special interphone system. An interphone set is also installed in the cargo compartment of the helicopter.

These Operating and Maintenance Instructions are compiled on the basis of extensive experience gained in operation of the helicopter and include all structural changes made on the machine.

SAFETY PRECAUTIONS

Prior to performing any kind of work on the helicopter be sure to take the following safety measures:

1. Ground the helicopter immediately after landing.
2. Switch off the circuit breakers of electrical equipment and the switches **STORAGE BATTERY (AKKUMVINTOP)** and **FEED FROM STORAGE BATTERY (CETB HA AKKUMVINTOP)**.
3. Connect ground power supply sources to the helicopter circuit only on permission of the flight engineer.④

If a power supply source is connected to the helicopter for inspections and maintenance, it is necessary to post an electrical sign **HELICOPTER ENERGIZED**.

4. Before releasing and retracting the work platforms of the engine and gear box compartments, doors of the special compartment as well as before checking the helicopter controls make sure that no people are present nearby. Warning commands should reach all the personnel located inside and outside the helicopter.

Opening (closing) of doors, access panels and release of work platforms are allowed only upon acknowledgement of return safety reports.

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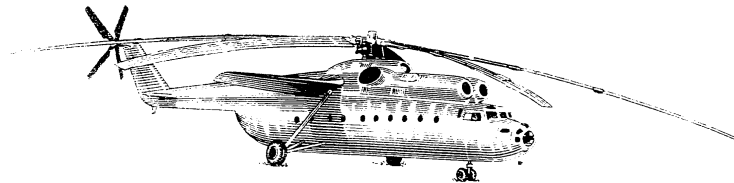


FIG. 1 HELICOPTER, RIGHT FRONT VIEW.

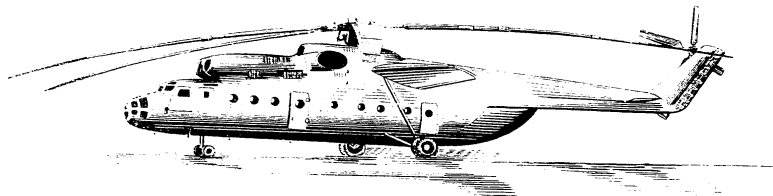


FIG. 2 HELICOPTER, SIDE VIEW.

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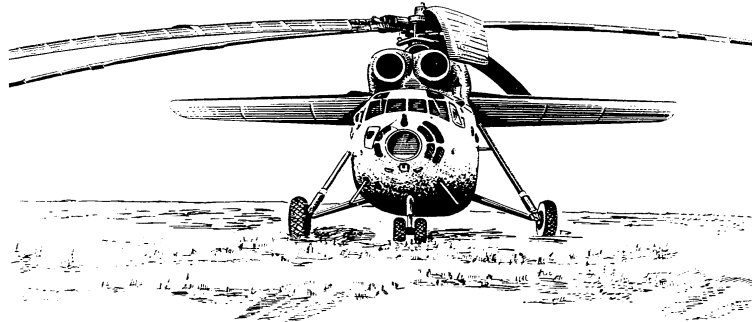


FIG. 3. H-46 HELICOPTER - FRONT VIEW.

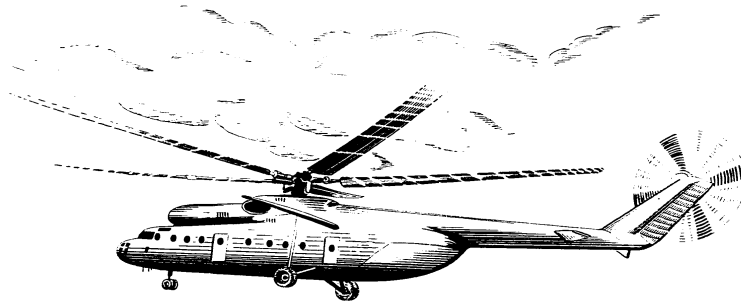


FIG. 4. H-46 HELICOPTER IN FLIGHT.

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5. Presence of personnel and performance of any kind of work in the engine and gear box compartments during operation (or cold cranking) of engines is prohibited. The upper access panel in the crew cabin should be kept closed.

6. During inspection of the power plant as well as during movement of the personnel along the work platforms after stopping the engines, care should be taken not to touch hot engine parts to avoid skin burns.

7. Not more than two persons are allowed to stand on the work platforms of the engine and gear box compartments.

8. All holes and interior of mechanisms and piping opened during disassembly, should be immediately blanked off with plugs and caps.

9. When operating helicopter instruments and equipment it is prohibited to leave free ends of cables non-insulated, or leave the electrical panels of distribution devices open and terminal panels of electrical equipment energized.

10. Prior to performing maintenance work on the engine or the power plant be sure to close the air blow-off bands. To do it, proceed as follows:

(a) turn off the plugs from the holes on the cylinder bottom of each air blow-off band control mechanism;

(b) feed air at a pressure of 40-50 kg/sq cm to the cylinders of mechanisms via the "25M" solenoid-operated air valve by setting the switch of the air blow-off band in CLOSED (ЗАКРЫТО) position;

(c) turn the dummy (shipping) bolts in place of the plugs into the threaded plug holes of the mechanism cylinder bottoms so that they bear against the cylinder pistons; ②

(d) relieve air from the cylinders by setting the switch of the air blow-off bands in OPEN (ОТКРЫТО) position. In this case the air blow-off bands should remain closed.

After performance of maintenance and other operations on the engine, the dummy (shipping) bolts should be replaced by plugs. The replacement procedure is considered in Section "Replacement of Engines".

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OPERATING INSTRUCTIONS

Chapter I

PREPARATION OF HELICOPTER FOR FLIGHT

The purpose of the pre-flight inspection is to check the readiness of the helicopter for flight and to find out troubles which might occur during the parking period.

During maintenance operations involving presence of the maintenance personnel on the top skin of the fuselage, measures should be taken to ensure adequate safety. One of these measures is the use of hold-on belts by the personnel.

I. PRELIMINARY OPERATIONS

1. Disconnect the tie-down wire ropes (if any) from the main rotor blades. Remove protective jackets from the fuselage, gear boxes, hubs of main and tail rotors, blades of main and tail rotors, Pitot tubes and PE-2 altimeter aeriels.
2. Drain off 1-2 litres of fuel through drain valves of each group of tanks, interconnecting piping of upper fuel tanks, coarse and fine filters and make certain that the fuel is clean.
Open the fuel shut-off valves to drain fuel from filters. Close the fuel shut-off valves after draining.
3. In case of icing or snow fall remove ice, hoar-frost and snow from the fuselage, wing, tail boom, and the stabilizer.
4. Remove blanking covers from the intake and outlet ducts of the engines and the fan (5 covers altogether).
5. Install the air-borne storage batteries on the helicopter and connect them to the helicopter mains (in case they were removed from the helicopter). ⑤

II. PRE-FLIGHT INSPECTION

Inspection and checking of the helicopter should be performed in conformity with the pre-flight walk-around procedure shown in Fig.5 in the following sequence:

1. Port side of fuselage:
 - (a) inspect the nose portion of the fuselage and see that there is no damage to the skin, glass panels, Pitot tube and aeriels;
 - (b) inspect the port side of the fuselage and see that there is no visible damage to the skin, windows and doors;

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- (c) make sure that the doors of the cargo compartment, access panels and entrance doors are closed tightly;
- (d) check attachment of the left external tank.
- 2. Left main L.G. leg:
 - (a) inspect the shock strut of the leg and see that there is no fluid leakage through the seals;
 - (b) make sure that the wheel tyre is not damaged and check the tyre deflection;
- 3. Tail boom and stabilizer:
 - (a) inspect the stabilizer and see that it contains no mechanical damage;
 - (b) inspect the tail boom and see that it is free from mechanical damage;
 - (c) inspect the intermediate gear box. See that there is no mechanical damage and traces of oil leakage.
- In case oil leakage is detected, check the oil level by the dipstick, trace and eliminate the cause of trouble.
- 4. Tail rotor and fin beam:
 - (a) inspect the tail rotor blades and the hub as well as the tail beam and make sure they are free from mechanical damage;
 - (b) inspect the tail gear box and see that there is no mechanical damage and traces of oil leakage.
- 5. Right main L.G. leg:
 - (a) inspect and check the right leg within the scope indicated in Para.2 of the present Chapter.
- 6. Fuselage starboard:
 - Inspect and check the fuselage starboard within the scope indicated in Para.1 of the present Chapter.
- 7. L.G. nose leg:
 - (a) inspect the shock strut and make sure that there is no fluid leakage through the seals;
 - (b) make sure that the wheel tyres are not damaged and the tyre deflection is within the prescribed limits.
- 8. Cargo compartment:
 - (a) inspect the entrance doors, windows and access panels on the fuselage ceiling. Make sure that there is no mechanical damage;
 - (b) check the cabin equipment for proper attachment;
 - (c) make sure the air-borne portable fire extinguishers are present and sealed.
- 9. Left engine:
 - (a) check the oil level in the engine oil tank;
 - (b) inspect the engine air intake. See that it is free from mechanical damage and foreign objects;
 - (c) check to see that there is no fuel and oil leakage at the joints of piping and units as well as oil leakage through gaskets of bearings of the free turbine (in the exhaust pipe) and leakage of the oil coolers.

CUTIONS: 1. When performing any kind of work in the engine compartment with the air blow-off bands open, care should be taken that no foreign objects get into the engine.

2. When the engine is out of use for long periods of time, oil may leak from the oil tank into the engine. If after a long parking period (over 24 hours) the oil level in the oil tank decreases by 5-10 litres, it is necessary to start the engine and let it run at idling speed (with the

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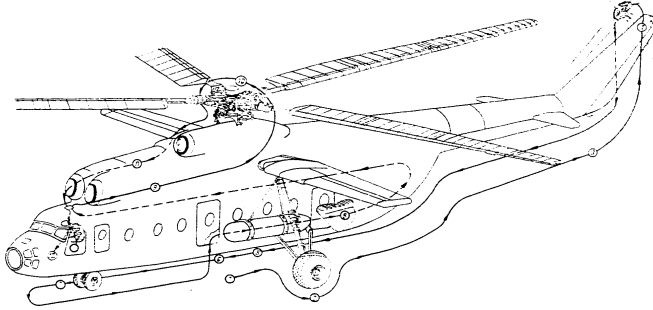
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FIG. 5. PRE-FLIGHT WALK-AROUND INSPECTION

1 = port side; 2 = left main L.A.G. leg; 3 = tail boom and stabilizers; 4 = tail rotor and tail boom; 5 = right main L.A.G. leg; 6 = fuselage starboard; 7 = L.A.G. nose leg; 8 = cargo compartment; 9 = left power plant; 10 = main rotor hub, gear box compartment, swashplate, and main rotor blades; 11 = right power plant; 12 = crew cabin.

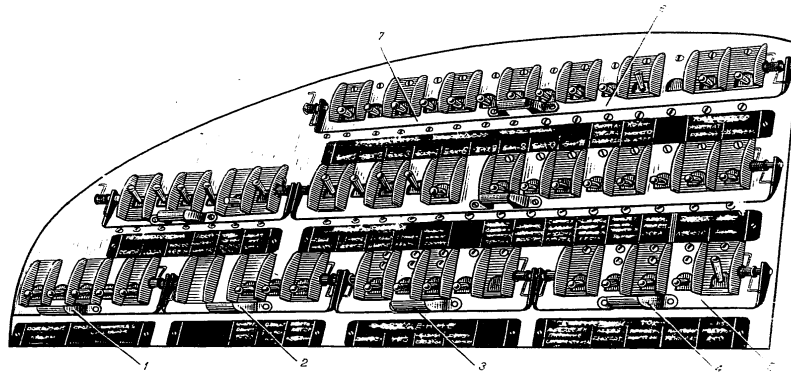


FIG. 6. FLIGHT ENGINEER'S CIRCUIT BREAKER PANEL

1 = fuel shut-off valve circuit breaker and control common switch; 2 = cabin ventilation and heating circuit breaker and control common switch; 3 = lighting system (dome lamps, ultraviolet irradiation, landing lights, extension lamps) circuit breaker and control common switch; 4 = fuel system circuit breaker and control common switch; 5 = common control switch and circuit breakers for engine starting system, engine and gear box indicators, rotor pitch indicator, fan blade indicator, and air blow-off fan indicator; 6 = common switch and circuit breakers for fuel consumption control system, fuel quantity gauges, and fuel consumption signaling system; 7 = common switch and circuit breakers for hydraulic system, cargo ramps control system, and signaling system.

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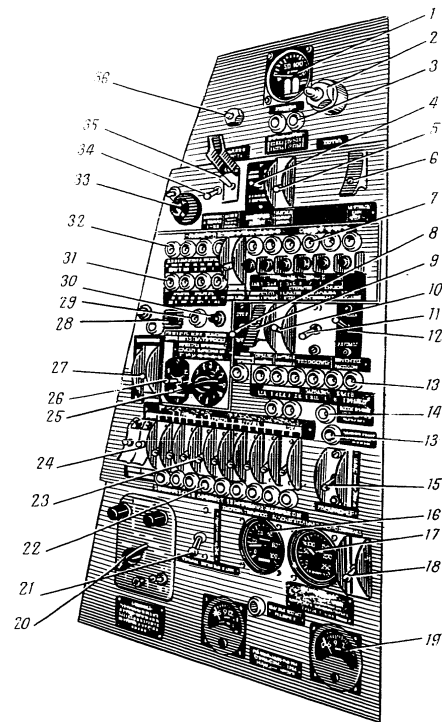
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FIG. 7. FLIGHT ENGINEER'S CONTROL PANEL

1 - 100% oxygen indicator; 2 - oxygen valve; 3 - cargo ramps and cowls OPEN warning lamps; 4 - cabin heating switch; 5 - storage battery heating circuit breaker; 6 - inert gas switch; 7 - fire fighting system button 5 K. switch, and warning lamps; 8 - IV tank group filling valve switch; 9 - refuelling indicator system switch; 10 - inboard refuelling equipment switch 21111-45; 11 - fuel quantity gauge switch 21111-250; 12 - fuel consumption control switch 21111-250; 13 - tank fuel level indicator lamps; 14 - tank pump operation warning lamps; 15 - fuel flowmeter switch 21111-250; 16 - air pressure gauge MB-100; 17 - hydraulic pressure gauge 21111-240; 18 - electric pump control switch B11-45; 19 - voltmeter 134-150 for checking parallel operation of A.C. generators; 20 - interphone set (from C111-7 set); 21 - lamp checking switch 11-4; 22 - automatic fuel consumption indicator lamps; 23 - fuel feed switch; 24 - fuel shut-off valve switch; 25 - fire detector checking switch; 26 - fire detector circuits change-over switch; 27 - fire detector check switch; 28 - fire warning system cut-off button; 29 - ENGINE ON FIRE warning signal cut-off button; 30 - II series fire extinguishers control button; 31 - II series fire extinguishers ENGAGED warning lamps; 32 - automatically discharged fire extinguishers warning lamps; 33 - ultra-violet light irradiation rheostat P.N. 1-45; 34 - ground power supply switch, ~115 V; 35 - cargo ramp selector switch 1111-45; 36 - oxygen reducer KP-14A.

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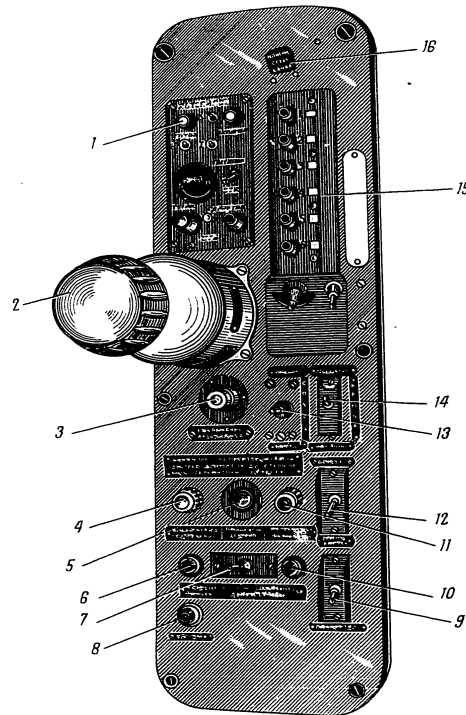
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FIG. 8. PILOTS' CABIN MASTER CONTROL CONSOLE
 1 - autopilot control panel; 2 - autopilot control knob;
 3 - autopilot disengagement button; 4 - left engine
 AUTOMATIC SYSTEM ON (АВТОМАТИКА ВКЛЮЧЕНА)
 indicator lamp; 5 - STARTING OFF (ОСТАНОВКА
 ЗАПУСКА) button; 6 - LEFT ENGINE STARTING
 (ЗАПУСК ЛЕВОГО ДВИГАТЕЛЯ) button; 7 - engine
 starting selector switch; 8 - navig. light code (КОД-
 АНО) button; 9 - mode selector switch; 10 - RIGHT
 ENGINE STARTING (ЗАПУСК ПРАВОГО ДВИГАТЕЛЯ)
 button; 11 - right engine AUTOMATIC SYSTEM ON
 (АВТОМАТИКА ВКЛЮЧЕНА) indicator lamp; 12 -
 GROUND-AIR (ЗЕМЛЯ-ВОЗДУХ) selector switch; 13 -
 COMMAND RADIO SET - STAND-BY interphone set
 (КОМАНДИРАЯ Р/СТАЦИЯ - РЕЗЕРВН. СЛ) selector
 switch; 14 - wing control switch; 15 - radio station control
 panel; 16 - CHANNEL RESET (СБРОС КАНАЛА) button.

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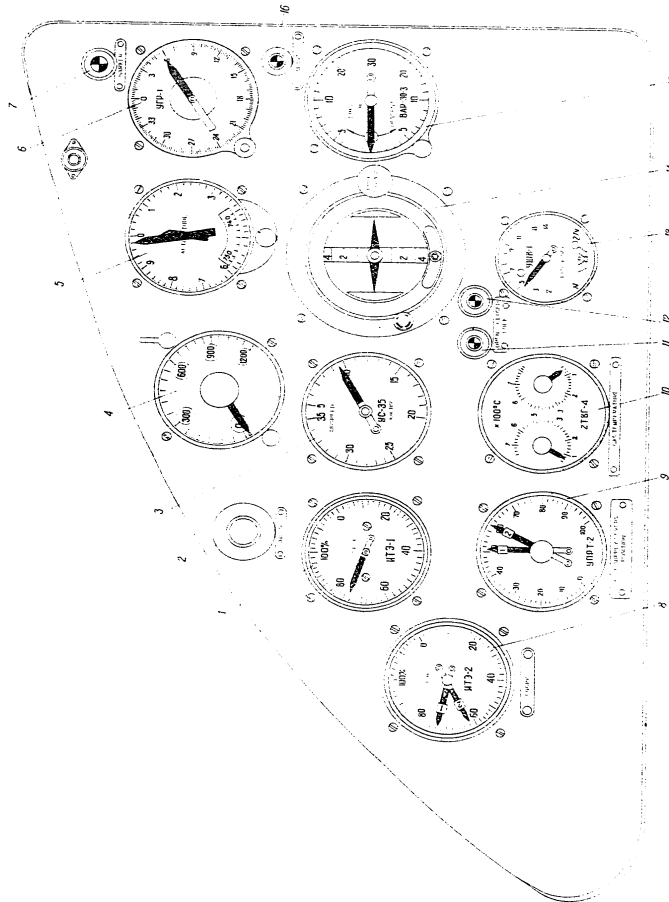


FIG. 9. LEFT-SIDE PANEL OF PILOT'S INSTRUMENT BOARD

1 - main rotor speed indicator [11] 1; 2 - fuel lever position indicator [11] 2; 3 - radio altimeter indicator [11] 3; 4 - engine speed indicator [11] 4; 5 - marker receiver indicating light; 6 - fuel lever position indicator [11] 6; 7 - fuel lever position indicator [11] 7; 8 - fuel lever position indicator [11] 8; 9 - fuel lever position indicator [11] 9; 10 - fuel lever position indicator [11] 10; 11 - fuel lever position indicator [11] 11; 12 - fuel lever position indicator [11] 12; 13 - fuel lever position indicator [11] 13; 14 - fuel lever position indicator [11] 14; 15 - fuel lever position indicator [11] 15; 16 - fuel lever position indicator [11] 16.

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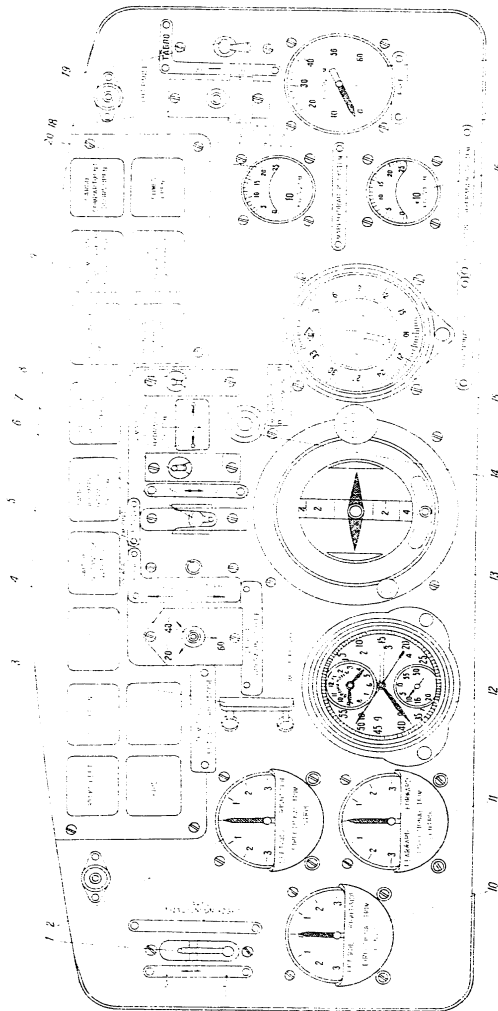
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FIG. 9A. MIDDLE PANEL OF PILOT'S INSTRUMENT BOARD

- 1 - indicating lights check switch; 2 - lateral trim control indicator; 3 - trim control selector switch; 4 - de-icing system switch; 5 - 110V-500W inverter switch; 6 - 110V-100W inverter switch; 7 - main hydraulic system switch; 8 - duplicating hydraulic system switch; 9 - light panel; 10 - foot trim control indicator; 11 - longitudinal trim control indicator; 12 - A/C-1 clock; 13 - gyro horizon; 14 - main hydraulic system indicating light; 15 - directional gyro indicator; 16 - duplicating system indicator; 17 - air system indicator; 18 - main hydraulic system electric pump switch; 19 - light panel brightness switch; 20 - main hydraulic system indicator.

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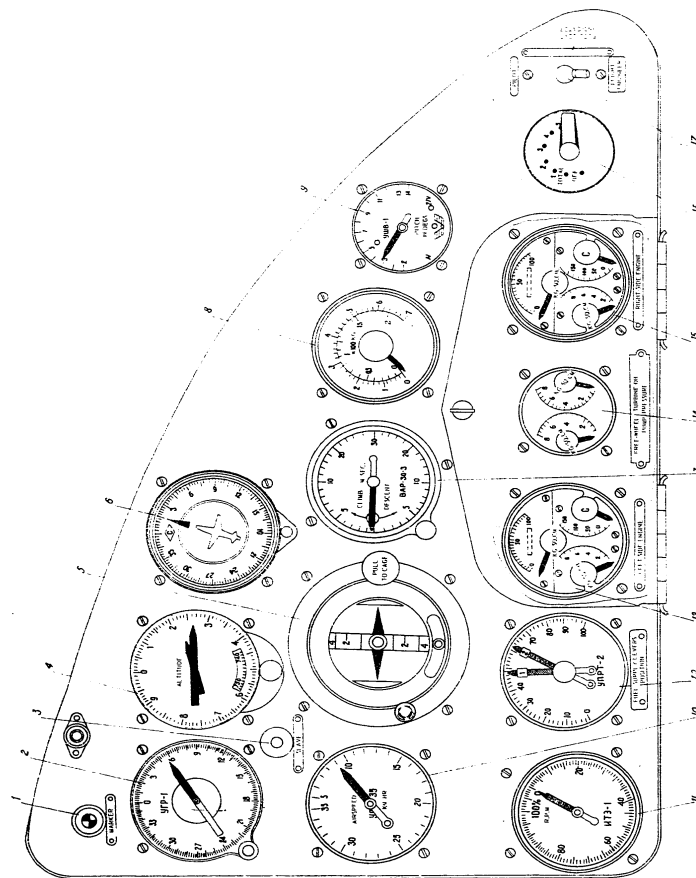


FIG. 10. RIGHT-SIDE PANEL OF PILOT'S INSTRUMENT BOARD

1 - NEPT-561 marker receiver indicating light; 2 - indicator VTP-1; 3 -
 IKT-1 compass slaving button; 4 - altimeter IKT-10; 5 - gyro horizon
 IKT-40; 6 - indicator IKT-40; 7 - vertical speed indicator BAP-30-3;
 8 - fuel quantity gauge indicator; 9 - main rotor pitch indicator; 10 - airspeed
 indicator VC-15; 11 - main rotor speed indicator MT-1; 12 - fuel lever
 position indicator; 13 - left engine three-pointer indicator; 14 - free turbine
 oil pump pressure indicator; 15 - right engine three-pointer indicator; 16 -
 fuel quantity gauge switch IKT-5; 17 - fuel quantity gauge indicator switch.

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twist grip turned to the right and left for 10 minutes so as to pump off the oil collected in the engine. After stopping the engine check the oil level in the oil tank and top up the tank with new oil to 23 litres. If the amount of oil decreases by more than 10 litres, drain off the oil before starting the engine and fill the tank with new oil.

10. Main rotor hub, gear box compartment, swashplate and main rotor blades:
 - (a) inspect the main rotor hub and the swashplate. See that the lock wire of connections is in good condition and there is no mechanical damage;
 - (b) check the dampers and hinges of the hub for oil leakage;
 - (c) inspect the main rotor blades and make sure they are free from damage and their surfaces are clean;
 - (d) check pressure in the fire extinguisher bottles;
 - (e) check the fluid level in the hydraulic reservoirs;
11. Right engine:

Inspect and check the right engine within the scope indicated in Para.3.
12. Crew cabin:
 - (a) check position of the door jettison knobs and presence of cap seals on them;
 - (b) check pressure in the air system and functioning of the landing gear wheel brakes. To this end, depress the brake lever and make sure that the pressure in the wheel brakes is 12 kg/sq cm;
 - (c) with the power sources connected into the mains check the fuel level by the fuel level gauge to determine the total amount of fuel and the amount of fuel contained in each group of tanks;
 - (d) check the condition of electrical circuits of the chip-detecting filters by connecting the power supply and turning on the packet switch VALVE CHECKING (ПРОВЕРКА ЛАМП) on the flight engineer's control panel. If the circuits are in good condition, two pilot lamps of the 4C-23 filters should come on;
 - (e) check functioning of the flight controls as follows:
 - the longitudinal, lateral, collective pitch and the foot control systems - by manipulating the left and right levers of the cyclic pitch, the collective pitch levers and pedals within the limits of their travel;
 - the longitudinal and lateral trim control systems - by alternate depression of the push-buttons on the left and right control sticks;
 - the foot trim control system - by alternate depression of the toe brakes.

The check should be performed by means of the УНП-250М hydraulic trolley or the 465W motor-driven pump of the helicopter main hydraulic system;

 - (f) see that there is no binding of the microswitch rods of the duplicating system emergency control mechanisms. To effect this, use a portable lamp and a mirror for inspection of the microswitch rods on the linkage of the longitudinal and lateral control systems as well as on the linkage of the collective pitch control so as to find corrosion on the rods. De-energize the electrical system and depress 3-4 times the rod of the microswitch to check its functioning. In case of corrosion or binding of the rod, the microswitch should be replaced;
 - (g) check condition and cleanliness of the cabin glass panels;
 - (h) check reliability of attachment of the seats and condition of the fastening belts, functioning of the seat adjustment and tilting mechanisms.
13. Check functioning of the fire fighting system detectors by switching the circuit breakers of the fire fighting system on the flight engineer's circuit

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breaker panel and turn on the switch of the fire fighting system located on the flight engineer's control panel. After performing the above operations proceed as follows:

- (a) set the switch in DETECTOR CHECKING position on the flight engineer's control panel. In this case the red pilot lamp indicating that the detectors are switched for checking should come on;
- (b) set the switch for checking the fire detectors by groups to fig. "1" and check functioning of the detectors by successively setting the channel change-over switch located on the flight engineer's panel from the neutral position to positions FIRST CHANNEL (1-й КАНАЛ), SECOND CHANNEL (2-й КАНАЛ) AND THIRD CHANNEL (3-й КАНАЛ). If the detectors function properly the pilot lamp indicating fire danger should come on; when the switch is placed into the neutral position the lamp should go out;
- (c) check the fire detectors of the other groups from figure "2" to "9" within the scope indicated in Para."b". To do this, set the channel change-over switch from the neutral position to channels "1", "2" and "3".

Note. If the pilot lamp VALVE OPEN (КРАН ОТКРЫТ) does not go out but flickers when the channels change-over switch is set in the neutral position, (this indicates that the fire fighting valve in the valve battery is defective). setting of the fire detector check switch in EXTINGUISH. (ОПРЕДЕЛ.) position is prohibited because it may result in discharge of the automatically actuated fire bottles;

- (d) when the fire detector check switch (for group checking) is in positions "1" and "2" (during successive manipulation of the switch from position "0") the light panel of the air blow-off band of the left engine should go out; when the switch is in positions "3" and "4", the light panel of the air blow-off band of the right engine should go out which indicates that the air blow-off band of the respective engine is closed. In the course of further setting of the switch in any position except for "1-4" the light panel of the air blow-off band should come on anew which indicates that the air blow-off bands get open. If any of the light panels indicating the opening of the air blow-off band fails to come on, it is necessary to turn off and on the switch of the fire-fighting system; in this case the light panel should come on.

If the light panel of the air blow-off band fails to come on again, the trouble should be found and eliminated before the take-off.

14. Perform the pre-flight preparation of the radio, electrical equipment and instruments of the helicopter in conformity with the "Helicopter Operating Instructions", Book IV.

15. The fire detector check over, proceed as follows:

- (a) set the channel change-over switch in the neutral position; as a result, the pilot lamp VALVE OPEN should go out. Set the switch for checking the fire detectors by groups to position "0";
- (b) set the fire detector check switch in EXTINGUISH position; as a result, the red pilot lamp DETECTOR CHECK should go out.

Note. When checking the fire fighting system it is necessary to check the fan blades for automatic closing. To do this, proceed as follows:

- raise the pressure in the hydraulic system to 155 kg/sq cm;
- switch on the emergency closing of the fan blades circuit breakers;
- set the switch to figure 5 or 6 (gear box compartment); as a result, the fan blades should get closed;
- open the fan blades by setting the B-45 switch of the fire fighting system first in OFF position and then in ON position. ⑤

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III. PREPARATION FOR STARTING

Prior to engine starting remove all foreign objects found around the helicopter.

In operating the helicopter under field conditions when the ground may be dusty or sandy it is necessary before the engine starting to clear the ground around the helicopter from small stones and hard objects and to water the ground, if necessary.

The sequence of starting of several helicopters should be so established that during acceleration of the helicopter transmission the air flow from the previously started helicopter is not driven by wind towards the engine being started.

Prior to engine starting make sure that:

- the blanking covers of the engines and the fan are removed;
- the helicopter is provided with fire extinguishers.

1. Connect the ground power supply sources (АПА-2М unit or a storage battery trolley of not less than 220 A-hr capacity) or switch on the helicopter power supply source. When connecting the АПА-2М unit the generator cable should be connected to the front receptacle and the cable of the storage battery should be connected to the rear receptacle.

2. Retract the work platforms of the engine and gear box compartments, close the upper access panel of the crew cabin and remove steps.

3. Occupy the seats in the crew cabin.

4. Unbrake the main rotor by moving the brake lever fully down.

5. Switch on all the circuit breakers required for engine starting:

- circuit breakers indicating operation of the oil systems of engines and gear boxes;
- circuit breakers of the hydraulic systems (main, duplicating and auxiliary);
- circuit breakers of the fire fighting system;
- circuit breakers of the measuring and indicating instruments;
- circuit breakers of the fuel shut-off valves;
- circuit breakers of the fuel consumption control system;
- circuit breakers of the starting system;
- circuit breakers of the longitudinal, lateral and directional trim control systems of the helicopter.

6. Set the switch of the fire fighting system located on the flight engineer's panel in ON position.

7. Make sure that the fuelling valve of the seventh fuel tank is closed - the pilot lamp CLOSE VALVE (ЗАКРОЙ КРАН) is not burning.

8. See that the switches of the D.C. generators are in OFF position, switches GROUND STORAGE BATTERIES AND HELICOPTER POWER SUPPLY SOURCES and FEED FROM STORAGE BATTERY are in ON position, the voltage check switch is placed in 11 RECEPTICLE position (to avoid overshooting of the pointer of the helicopter voltmeter during starting), the circuit breakers of the A.C. generators are in OFF position.

9. Using a ground power supply engage the 465M pump, raise the pressure in the helicopter hydraulic system and make sure that the engine controls and the collective pitch controls of the main rotor function properly by manipulating the collective pitch-throttle control lever within the whole range of travel up and down. The lever

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should travel smoothly, without binding; the readings of the dials of the HP-23 unit of both engines (by the VHTF indicator) should be synchronized within 2° .

Note. The 465V pump should be engaged and operated as instructed in Section "Operation of 465V Pump During Check of Helicopter Controls" (see page 132). (4)

10. Check position of the controls and set them accordingly for engine starting:

- (a) make sure (by the pitch indicator) that the collective pitch-throttle control lever is placed in the lower position and turn the twist grip to the extreme right;
 - (b) set the engine selector control lever in the neutral position (in the central depression of the sector) and fix it in this position;
 - (c) set the trim controls 1-1.5 divisions back and 0.5-1 division to the right.
11. Make sure that the engine stop cocks "KO" are in CLOSED position and the dial levers of the HP-23 units are on the idling rating sector (15° - 18° by the indicator).

12. Open the fuel shut-off valves of the left and right engines.

13. Set the fuel consumption control switch in AUTOM. (ABTOMAT) or MANUAL (PYVHOR) position and switch on the fuel booster pump of the tank. In this case the pressure in the fuel line before the HP-23 pump should be 0.6-0.8 kg/sq cm.

Note. If the fuel consumption control switch is set in MANUAL position, the booster pumps of the fuel groups should be engaged manually in conformity with the fuel consumption sequence from the tanks.

14. Act as follows:

(a) set the starter-generator mode of operation switch to COLD CRANKING position;

(b) place the engine selector switch to LEFT or RIGHT position.

15. Sound the command warning about the beginning of engine cranking. Perform cold cranking by depressing the STARTING push button of the engine to be run for 1-2 sec. The duration of cold cranking is determined by the HCT-I2TB starting panel and is equal to 28-32 seconds. The speed of the compressor rotor during cold cranking should be 9.4-14.17 (1000-1500 r.p.m.). In the course of cold cranking it is necessary to check the oil pressure in the engine which should be not less than 0.2 kg/sq cm.

16. Listen to the running engine when it is operating after the starter-generator has been switched off.

17. Perform cold cranking of the other engine in the similar way.

18. After the engine has been stopped, disengage the booster fuel pump, close the fuel shut-off valve and disconnect the power supply.

Note. Cold cranking of the engine is performed in the following cases:

- (a) when the engine stand-by period exceeds 5 days;
- (b) when not sure that the engine is in good repair;
- (c) when draining oil from the engine oil sump;
- (d) after an unsuccessful starting if the fuel did not start burning;
- (e) before the first starting of a newly installed engine.

19. Perform pressure-testing of the fuel system prior to the first starting of a newly installed engine, during replacement of units or pipelines of the fuel system as well as in case fuel has been fully drained from the helicopter fuel system. The pressure-testing should be performed as follows:

(1) Connect the power supply source. Switch on the circuit breakers of electrical instruments and automatic devices.

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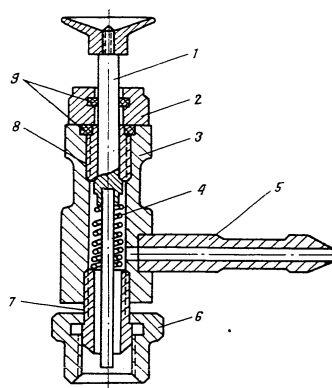


FIG. 11. DEVICE 18-19-833 FOR BLEEDING AIR
FROM FUEL SYSTEM
1 - actuating rod; 2 - cap; 3 - body; 4 - spring; 5 -
pipe-union; 6 - nut; 7 - sleeve; 8 - sleeve; 9 - sealing
rings.

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- (2) Open the fuel shut-off valve.
- (3) Engage the booster fuel pump of the 9th or 11th tank.
- (4) Upon engagement of the booster pump it is necessary to bleed air from the fuel system through the plug located on the HP-23A pump, using the 18-19-833 appliance taken from the tools kit (Fig.11).
- (5) Set the starter-generator mode of operation switch to COLD CRANKING position and the engine selector switch to the required position (LEFT or RIGHT).
- (6) Open the stop cock KO by pushing the cock lever.
- (7) Check the position of the engine controls. The collective pitch-throttle control lever should be placed in the extreme down position, the twist grip - in the extreme left position, the engine selector control lever - in the neutral position (locked). When the engine controls are in the above-indicated positions, the control lever of the HP-23A pump (the dial pointer) should be located on the idling rating sector. This corresponds to 15-18° by the T-2 indicator).
- (8) Sound the command warning the personnel about the beginning of cold cranking. Press down the engine starting button for 1-2 seconds. In the course of cranking it is necessary to check the rise of fuel pressure in the primary manifold by the pressure gauge. The pressure should be within 8-10 kg/sq cm.
- (9) At the end of cranking set the stop cock KO to CLOSED position and when the engine comes to a complete standstill, close the fuel shut-off valve and disconnect the power supply sources.

IV. ENGINE STARTING

Engine starting, warm-up and test-running is allowed at the following wind velocities: head wind - up to 20 m/sec; cross wind - up to 10 m/sec; rear wind - up to 5 m/sec.

The starting is performed in the following order:

- (1) Prepare the engine for starting as instructed in Section III, Chapter I;
- (2) Give a command warning the personnel about the beginning of starting;
- (3) Set the starter-generator mode of operation switch to STARTING and the engine selector switch in the required position depending on the engine to be started (LEFT or RIGHT).

Note. To ensure uniform operation (wear) and loading of the engines and the gear box of the helicopter it is recommended to alternate engine starting.

- (4) Check the position of the HP-23 pump control lever which should be in IDLING RATING position (15-18°) by the VNEPT-2 indicator.
- (5) Open the fuel shut-off valve (the stop cock "KO" should be closed).
- (6) Engage the booster pump of the 4th or 5th group of tanks.
- (7) Depress the engine starting button for 1-2 seconds. In this case the pilot lamp AUTOM. ON (АВТОМАТИКА ВКЛЮЧЕНА) comes on and the engine starts running. When the speed of the compressor rotor reaches 1000-1500 r.p.m. (9-14%) the stop cock should be set from CLOSED to OPEN position.

Note. Depending on the ambient air temperature (t_{amb}) it is recommended to set the stop cock in OPEN position at the engine speed $n_{c.t.}$ (c.t. stands for compressor turbine) in compliance with the Table.

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Engines	Compressor r.p.m.	Ambient air temperature			
		above 0°C	from -1 to -15°C	from -16 to -30°C	below -30°C
II series	n.c.t., # by MT3-2 indicator	12-14	11-12	10-11	9-10

(8) During starting it is necessary to check the following parameters:

- (a) voltage of the ground (the helicopter) power supply source;
- (b) disconnection of the starter generator which should take place automatically 46-3 sec after depression of the starting button or earlier when the engine speed reaches 3500±100 r.p.m. (32.9±1%);
- (c) rise of gas temperature after the compressor turbine which should not exceed 600°C for II series engines;
- (d) rise of fuel and oil pressure in the engine, oil in the free-wheeling clutch, oil in the P-7, HP-6 and XP-6 gear boxes (in the HP-6 and XP-6 gear boxes the pressure at starting may reach the maximum value as indicated by pressure gauges);
- (e) rise of pressure in the main and duplicating hydraulic systems.

CAUTION. If the duplicating system engages after the engine starting (the red light panel indicating operation of the duplicating system is burning, and the green pilot lamp of the main system is dead), it is necessary to switch off and then and to switch on the circuit breakers of the main hydraulic system located on the flight engineer's panel.

The duplicating system may have engaged in that case because of spontaneous operation of the end switches which have cut off the main system in the event of excessive loads in the control system (this may take place as a result of loading the controls located in the cabin during the pre-flight preparation or other work when the helicopter is under current, the circuit breakers are switched on but the pressure in the main hydraulic system is equal to zero).

(9) The engine automatically reaches the idling rating speed within not more than 120 sec from the instant of depression of the starting button.

$$n_{c.t.} = 5500 \pm 100 \text{ r.p.m. (51.7} \pm 1\%).$$

When the engine reaches the idling rating speed, the oil pressure in the engine should be not less than 2 kg/sq cm and the gas temperature after the turbine - not higher than 550°C.

(10) Set the engine starting switch to the other engine.

(11) The procedure of starting the other engine is similar to that of the previous one.

Notes: (a) the ignition system is switched on automatically (together with the starter) after the starting button has been depressed;
(b) during first 8 seconds of starting the current greatly fluctuates; at the end of this period the current consumed by the starter-generator should get stabilized at 450 A and 40-48 V.

In this case the voltage is checked by the helicopter voltmeter with the switch set to the GROUND RECEPTACLE. Failure of the engine to gain the idling rating speed may be caused by drop of voltage below 18 V.

(c) if the starter-generator fails to get disengaged by the end of the starting period (or by the moment the engine reaches the r.p.m. indicated above) it should be disengaged manually by means of the emer-

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gency STARTING STOP button. If this measure yields no results, the starting procedure should be immediately discontinued by means of the ENGINE STOP (STOP) switch; *cut the engine off.* ②

(d) to ensure normal starting of the engine at ambient air temperature below -10°C it is allowed to decrease the starting capacity of the HP-23 pump by turning off the screw of the starting control unit (A3) through 2-3 revolutions;

(e) when starting the cold engine at ambient air temperatures below zero the rise of oil pressure is allowed within the following limits: at the inlet to the turbo-compressor section of the engine - not more than 6 kg/sq cm and at the inlet to the gear box, transmission and the turbine - not more than 8 kg/sq cm.

(If the oil pressure rise exceeds the above indicated limits, it is necessary to eliminate the trouble in conformity with the recommendations contained in the A-25B engine operating instructions.) ③

When the rise of oil pressure runs out of the prescribed limits, discontinue the engine starting, perform cold cranking and repeat the starting procedure. If the oil pressure rise remains beyond the prescribed limits, proceed as follows:

In case of oil pressure rise at the inlet to the turbo-compressor section of the engine drain off the oil from the lower drive gearbox and the oil tank, fill the tank with oil heated to a temperature of $50-90^{\circ}\text{C}$, perform cold cranking and then start the engine anew.

In case of oil pressure rise at the inlet to the gear box or at the inlet to the transmission or the rotor turbine it is recommended to heat up the gear box with warm air, especially the installation places of the MHP-23 and MH-7 oil pumps and their relief valves, after which perform cold cranking and start the engine again. The gear box should be heated until the temperature in the oil sump rises by 5°C higher than the temperature at which the oil pressure rise took place.

(12) Engine starting should be discontinued in the following cases:

- (a) if the gas temperature after the turbine exceeds the allowable limits;
- (b) when the engine fails to accelerate to the idling rating;
- (c) if the generator fails to get disengaged automatically or by the emergency switch;
- (d) if the fuel does not ignite;
- (e) in the event of fuel or oil leakage or other irregularities in the operation of the engine or engine units;
- (f) in case of sudden oil pressure rise in the engine or the gear box;
- (g) if the pressure gauge shows no pressure at speed $n_{c.t.} = 1000-1500$ r.p.m. (the pressure should be not less than 0.2 kg/sq cm).

Engine starting should be stopped by setting the stop cock from the working position to CLOSED position and by disengaging the starter-generator by means of the STARTING STOP button if it fails to become disengaged automatically. In the latter case the control lever of the HP-23 pump should stay in the IDLING RATING position.

Note. When starting the engine by the helicopter storage batteries make use of the generator of the running engine for starting the other engine. To do this proceed as follows:

- (1) bring the running engine to the idling rating;
- (2) engage the generator of the running engine;
- (3) set the switch to start the other engine and depress the starting button for 1-2 sec;
- (4) when the engine reaches the idling rating engage the generator of the other engine.

CAUTION. (a) The repeated starting should be attempted only after complete stopping of the engines but not earlier than 3 minutes after disengagement of the starter. It is allowed to make not more than 5 attempts to start the engine;

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(b) the interval after every 5 attempts of starting should be not less than 15 minutes so that the starter generator can get cooled;

(c) the repeated starting is allowed only after the trouble has been found and corrected;

(d) when it appears necessary to perform engine cranking just after the hot starting with a view to finding and correcting the trouble, make sure that the pointers of the VMPT-2 indicator are set to 15-18°;

(e) prior to starting the first engine, both switches of the generators should be in the OFF position.

(13) After engine starting switch off the ground power supply sources (as a result, the pilot lamps indicating the connection of the ground power supply sources should go out).

(14) Switch on the left- and right D.C. generators one after another. As a result, the red pilot lamps on the flight engineer's board

indicating failure of the generators should go out and the pointers of the ammeters should deflect from zero positions to show a value corresponding to the current consumed. When the difference between the ammeter readings is great carry out coarse adjustment of the generators by means of external resistors on the flight engineer's instrument board. The final adjustment of the generators is performed during engine testing.

(15) Set the FEED FROM STORAGE BATTERY switch to the OFF position.

(16) Make sure that the engines are operating properly at the idling rating and start the engine warm-up procedure.

V. ENGINE WARM-UP AND TEST-RUNNING

1. Warm-up of the engines and gear box should be carried out at idling rating speed equal to 5500±100 r.p.m. (51.7±1%) (by compressor) until the oil temperature at the inlet to the main gear box reaches +25°C in summer and +5°C in winter. The setting angle of the main rotor blades during the warm-up procedure should be of the minimum value (φ=1°), the collective pitch-throttle control lever - in the extreme down position with the twist grip turned to the extreme left.

Note. To prevent engine icing in winter period it is necessary to raise the oil temperature at the inlet to the turbo-compressor section of the engine to +60-80°C. In individual cases the oil temperature after the engine compressor is allowed to drop down to +20°C for not more than 1 hour.

2. When warming up the engines it is necessary to check functioning of the hydraulic boosters when actuated from the main and the duplicating hydraulic systems by means of switches installed on the pilots' central instrument board.

The parameters indicating the normal operation of the hydraulic system are as follows:

- the pressure in the system is within 120±5 - 155±5 kg/sq cm with the system controls moving smoothly, without jerks or binding;
- the green pilot lamp MAIN HYDRAULIC SYSTEM ON is burning;
- no pressure in the duplicating system.

After checking the main system and building the required pressure it is necessary to switch off the system and by manipulating the system controls make sure that the duplicating system functions normally and shows the following parameters:

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- the pressure in the duplicating system varies within 120 ± 5 - 155 ± 5 kg/sq cm
- the system controls moving smoothly without jerks or binding;
- the red light panel DUPLICATING SYSTEM ON is burning;
- the green pilot lamp MAIN HYDRAULIC SYSTEM ON is dead;
- the pressure indicated by the main system pressure gauge is kept within the specified limits (120 ± 5 - 155 ± 5 kg/sq cm). *Switch main hydraulic system on.*

3. Check functioning of the auxiliary hydraulic system by the readings of the pressure gauge installed on the flight engineer's *control* board and by a short-time engagement of the pilots' seats hydraulic control system. In this case the pressure in the system varies from 120 ± 5 to 155 ± 5 kg/sq cm.

4. After warming up the engine and gear box check their operation and parameters at the idling rating and start engine test-running.

CAUTION. If there is no ground for helicopter mooring, the engines should be test-run in succession, i.e. start and test one engine, then stop it and then start and test the other engine (the engines should be tested by the pilot).

5. The successive test-running of the engines should be carried out with the aid of the engine ^{separate} controls and the collective pitch-throttle control lever in the following order:

- (a) start and warm up the engine at the idling rating;
- (b) smoothly turn the twist grip to the extreme right position. The r.p.m. of the rotor turbine (n_{r.t.}) with one engine running may be less than 7800 r.p.m. In this case it is necessary to pull the engine selector control lever (without touching the collective pitch-throttle control lever) and raise the rotor turbine speed to 7800-8300 r.p.m.
- (c) using the engine selector control lever, set the required rating (by the VHP-2 indicator) with the rotor turbine speed kept within 7800-8300 r.p.m. by shifting the collective pitch-throttle control lever upward, i.e. by increasing the rotor turbine loading.

CAUTION. To avoid engine surge, the collective pitch-throttle control lever should be shifted from the extreme down position upward (i.e. loading of the rotor turbine) only after preliminary turning of the twist grip to the extreme right position and setting the rotor turbine speed within 7800 - 8300 r.p.m.

6. If tie-down means are available both engines can be test-run simultaneously. To effect this proceed as follows:

- (a) start both engines one after another and let them warm up at the idling rating;
- (b) smoothly shift the twist grip to the extreme right position. As a result, the speed of the rotor turbine of both engines should rise to 7800-8300 r.p.m.;
- (c) after the above r.p.m. are reached, simultaneously test-run the engines at various ratings by shifting the collective pitch-throttle control lever to the respective position.

7. Check the operation and parameters of the engine and the gear box at the idling rating, at 0.66 normal rating, at 0.85 normal rating, at the normal, combat and take-off ratings in conformity with the engine warm-up and test-running graph.

The engine ratings are to be set by the dial of the regulating fuel pump (by the VHP-2 indicator) and the speed of the rotor turbine. The parameters to be

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- the pressure in the duplicating system varies within 120 ± 5 - 155 ± 5 kg/sq cm
- the system controls moving smoothly without jerks or binding;
- the red light panel DUPLICATING SYSTEM ON is burning;
- the green pilot lamp MAIN HYDRAULIC SYSTEM ON is dead;
- the pressure indicated by the main system pressure gauge is kept within the specified limits (120 ± 5 - 155 ± 5 kg/sq cm). *Switch main hydraulic system on.*

3. Check functioning of the auxiliary hydraulic system by the readings of the pressure gauge installed on the flight engineer's *control* board and by a short-time engagement of the pilots' seats hydraulic control system. In this case the pressure in the system varies from 120 ± 5 to 155 ± 5 kg/sq cm.

4. After warming up the engine and gear box check their operation and parameters at the idling rating and start engine test-running.

CAUTION. If there is no ground for helicopter mooring, the engines should be test-run in succession, i.e. start and test one engine, then stop it and then start and test the other engine (the engines should be tested by the pilot).

5. The successive test-running of the engines should be carried out with the aid of the engine ^{separate} controls and the collective pitch-throttle control lever in the following order:

- (a) start and warm up the engine at the idling rating;
- (b) smoothly turn the twist grip to the extreme right position.
The r.p.m. of the rotor turbine ($n_{r.t.}$) with one engine running may be less than 7800 r.p.m. In this case it is necessary to pull the engine selector control lever (without touching the collective pitch-throttle control lever) and raise the rotor turbine speed to 7800-8300 r.p.m.
- (c) using the engine selector control lever, set the required rating (by the *UHPT-2* indicator) with the rotor turbine speed kept within 7800-8300 r.p.m. by shifting the collective pitch-throttle control lever upward, i.e. by increasing the rotor turbine loading.

CAUTION. To avoid engine surge, the collective pitch-throttle control lever should be shifted from the extreme down position upward (i.e. loading of the rotor turbine) only after preliminary turning of the twist grip to the extreme right position and setting the rotor turbine speed within 7800 - 8300 r.p.m.

6. If tie-down means are available both engines can be test-run simultaneously. To effect this proceed as follows:

- (a) start both engines one after another and let them warm up at the idling rating;
- (b) smoothly shift the twist grip to the extreme right position. As a result, the speed of the rotor turbine of both engines should rise to 7800-8300 r.p.m.;
- (c) after the above r.p.m. are reached, simultaneously test-run the engines at various ratings by shifting the collective pitch-throttle control lever to the respective position.

7. Check the operation and parameters of the engine and the gear box at the idling rating, at 0.66 normal rating, at 0.85 normal rating, at the normal, combat and take-off ratings in conformity with the engine warm-up and test-running graph.

The engine ratings are to be set by the dial of the regulating fuel pump (by the *UHPT-2* indicator) and the speed of the rotor turbine. The parameters to be

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checked are as follows: r.p.m. of the compressor rotor and the rotor turbine, gas temperature after the turbine, pressure and temperature of oil in the engine and gear box, fuel pressure upstream of the burners and the regulating fuel pump.

The instrument readings should meet the requirements indicated in Table 1.

8. At the compressor speed $n_{c.t.} = 8800 \pm 100$ r.p.m. (for 82.62 mm the HTG-2 indicator) check closing of the air blow-off bands by the pilot lamp.

9. At a speed of not less than 0.66 normal rating check the voltage and loading of the D.C. generators one after another.

Check parallel operation of the generators with electric power consumed in idling.

The difference in generator loadings should not exceed 50%.

If necessary, adjust parallel operation of the generators by means of external resistors.

The additional adjustment of parallel operation of the generators should be performed in flight.

10. With the free turbine speed of about 8000 r.p.m., check operation of the A.C. generators as follows:

(a) set the INVERTER-GENERATORS (ИНВЕРТОРАБОБАТЕЛ-ГЕНЕРАТОР) switch to GENERATORS position;

(b) switch on the left and right generators in succession and using the external resistors adjust the voltage of the generators to 115 ± 2.5 V as indicated by the A.C. voltmeter;

(c) switch on both generators, load them by switching the heating system of the main rotor blades and check the current and voltage; the current should be within the specified limits depending on the equipment to be loaded and the voltage should be equal to 115 V.

11. The engine test-running over, shift it smoothly, within 10-12 sec to the idling rating.

In case the engines are tested separately shift them to the idling rating in the following order:

(a) by shifting the engine selector control lever and the collective pitch-throttle control lever down one after another (in several steps), set the engine selector control lever in middle position (to be latched) and the collective pitch-throttle control lever - to the extreme down position;

(b) smoothly turn the twist grip to the extreme left position.

In case both engines are tested simultaneously set them at the idling rating by simultaneous shifting of the collective pitch-throttle control lever to the extreme down position with subsequent turning of the twist grip to the extreme left position.

12. If the helicopter is not to be flown just after the engine test-running, cool down the engines at the idling rating for 2-3 minutes and stop them as instructed in Section "Engine Stopping".

Notes: (a) To obtain the required engine rating in the range of the compressor rotor speed from 8300 to 8800 r.p.m. with the air blow-off bands closed it is necessary to raise the compressor rotor speed preliminarily to the r.p.m. at which the air blow-off bands close (8800-100 r.p.m.) or to a somewhat higher speed and then to reduce the r.p.m. to the required limits;

(b) the gas temperature after the turbine is determined by the Table depending on the measured r.p.m. of the compressor rotor and the ambient air temperature.

13. Checking engine acceleration ability.

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The engine acceleration ability should be checked during testing of a newly installed engine and further only in case of necessity (for instance, after replacement of the HI-30A pump).

The engines are checked for acceleration ability separately. If the helicopter cannot be tied down, the acceleration ability check like test-running of the engines at other ratings should be performed with one engine running. If tie-down means are available the acceleration ability can be checked with both engines running. In this case the engine which is not under check should operate at a rating corresponding to the extreme lower position of the collective pitch-throttle control lever and the twist grip in the extreme right position ($\approx 40^\circ$ by the VHP-2 indicator).

The acceleration ability is checked after test-running the engine and cooling it at the idling rating on condition the engine operating parameters at the take-off rating meet the technical requirements.

(a) Perform the acceleration ability check with both engines running as follows:

(1) Shift the engines from the idling rating to a rating corresponding to $\approx 40^\circ$ by the VHP-2 indicator and turn the twist grip to the extreme right position with the collective pitch-throttle control lever kept in the extreme lower position;

(2) when the rotor turbines reach 7800-8300 r.p.m., shift the engine selector control lever of the engine under check from the neutral position (from the latch) upward within 2-3 sec until it bears against the stop. As a result, the engine should accelerate from a rating corresponding to $\approx 40^\circ$ by the VHP-2 indicator to the take-off rating within 10-12 seconds. The acceleration time is determined by the moment when the fuel pressure upstream of the burners reaches the value corresponding to the take-off rating. The gas temperature after the turbine (temperature rise) should not exceed 640°C ;

(b) perform the acceleration ability check with one engine running in a similar way, but bear in mind that the rotor turbine speed corresponding to $\approx 40^\circ$ by the VHP-2 indicator may be below 7800 r.p.m. In this case use the engine selector control lever to increase the rotor turbine speed to 7800-8300 r.p.m. and then check the engine acceleration ability.

Note. If the rotor turbine speed during the acceleration ability check increases above 8500 r.p.m., it is necessary to increase the main rotor blade pitch by means of the collective pitch-throttle control lever, i.e. to increase the loading of the rotor turbine;

(c) let the engine run for 5-7 seconds at the take-off rating and slowly shift the engine selector control lever of the engine under check to the neutral position (to be latched) within 10-12 seconds;

(d) if necessary, check the acceleration ability of the other engine in a similar way;

(e) the acceleration check over, let the engine cool off at the idling rating and stop it as instructed in Section "Engine Stopping".

CAUTION. If during the ground testing of the helicopter growing lateral vibrations of low frequency (earth resonance) occur, proceed as follows: quickly shift the collective pitch-throttle control lever to the extreme low position and switch off the engines; periodically brake the main rotor until the vibration of the helicopter ceases completely. The rotor should be slowed by a smooth momentary application of the brake.

After stopping the engines the helicopter vibration may not cease immediately. However as the main rotor speed decreases, the vibration gradually disappears.

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CONFIDENTIAL**14. Check functioning of the helicopter de-icing system as follows:**

With the engines running at 0.65 nominal power, switch on the de-icing system for a 40 second cycle and measure the current in the circuits of consumers by the ammeter located on the flight engineer's panel.

The current should be equal to 220-270 A with the switch set in position "1-2" and "3-4", and 110-135 A with the switch set in position "5"; up to 100 A with the switch set in position for heating the tail rotor, glass panels, and the intake duct.

The voltmeter mounted on the flight engineer's panel should indicate 115 V for the right and left generators.

In case the voltage is too low or too high bring it to the required limits (to do it, with the engines operating at 0.65 nominal power, switch on the circuit breaker of the left generator, set the switch in position GENERATOR and using the external resistor of the left generator adjust the voltage to 115±0.5 V by the voltmeter). Then switch off the circuit breaker of the left generator, switch on the circuit breaker of the right generator and adjust the voltage of the right generator in the same manner. The adjustment over, check the voltage by the 20-250 voltmeter for the right and the left generators separately and in parallel operation. The voltage should be equal to 208±8 V.

If the current in the circuits of power consumers is within the specified limits, it indicates that the de-icing system functions normally.

During current checks in the circuits of the main rotor blade heaters the measurements should be taken in the root as well as the tip sections of the heaters. These checks are performed as follows:

- set the switch in position "1-2", and quickly check the current value in positions "3-4" and "5" when the ammeter pointer shows the maximum reading.

The current should be 220-270 A for position "1-2", "3-4" and 110-135 A for position "5". After the current value decreases wait until it grows to the maximum value and manipulate the switch to repeat measurements.

The above check is carried out during a single working cycle of the timing device (two minutes).

Since functioning of the de-icing system is checked with the engine operating at 0.65 nominal power, the duration of the check should not exceed 5 minutes so as to save the operating life of the transmission and the engines. (5)

CAUTIONS: 1. If the current value is not within the specified limits, the flight is not allowed until the trouble is eliminated.

2. During ground testing of the engines as well as during taxiing and take-off from unprepared landing strips (sandy, not cleared from stones and other foreign objects), the leading edge sections of the main rotor are likely to get damaged by foreign objects picked by the air flow from the ground. In this case prior to flight it is necessary to check functioning of the de-icing system at hovering conditions as instructed above in Para. 14.

The heating degree of glass panels of the pilots' and the navigator's cabins with the heating system switched on should be checked by handfeeling the glass from the cabins.

Note. Since the ammeter scale begins from 100 A, the presence of current during the check of the intake duct heating circuit should be determined by a slight shift of the pointer from the zero position. (6)

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Instrument Readings when Running Engines at Various Ratings on Ground (at $T = 15^{\circ}\text{C}$ and $P = 760\text{ mm}$ of mercury)

Table 1

Nos	Instrument readings	Ratings					
		Idling	0.66 normal	0.85 normal	Normal	Combat	Take-off
1	2	3	4	5	6	7	8
1	Free turbine speed, r.p.m.	2400-2600	at all ratings 2800-3000				
2	Compressor normal speed, r.p.m.	5500-5600 (measured)	5400-5500	5400-5500	5600-5700	5850-5900	5950-6000
3	Compressor normal speed (by HTG-2 indicator)	51.7-51	52.4-51	53.5-51	54.6-51	57.5-51	58.5-51
4	Dial of HT-23 pump, units (percent)	5-12	5-12	7-12	8A-12	9-12	9-13 stop
5	Continuous running time, minutes, max.	30	(not limited)	(not limited)	120	15	6
6	Gas temperature after turbine, $^{\circ}\text{C}$	550	Gas temperature after turbine for all other ratings is determined by Table No.2 depending on ambient air temperature				
7	Fuel pressure: (a) at inlet to HT-23 pump, kg/sq cm* (b) before burners, kg/sq cm		from 1.8 to 2.9				
8	Oil temperature at engine inlet, $^{\circ}\text{C}$: (a) minimum (b) recommended (c) maximum allowable		from 22 to 53				
			-40 $^{\circ}$ at all ratings				
			from +40 $^{\circ}$ to +80 $^{\circ}$ at all ratings**				
			+95 $^{\circ}$ at all ratings for not more than 5 minutes				

* The dancing of the pressure gauge pointer indicating the fuel pressure before the HT-23 pump is allowed within -0.3 kg/sq cm provided the fuel pressure is kept within the recommended range (1.8-2.9 kg/sq cm).

** In individual cases the recommended oil temperature at the inlet to the turbo-compressor of the engine may be allowed to decrease to +20 $^{\circ}\text{C}$ for not more than 1 hour. Before the helicopter enters the icing zone, the oil temperature should be kept from +60 to +80 $^{\circ}\text{C}$.

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1	2	3	4	5	6	7	8
9	Oil pressure in engine, kg/sq cm	not less than 2 at idling rating					3.0-4.8 (with oil temperature at engine inlet from -40° to +95°C at all ratings)
10	Oil temperature at inlet to main gear box, °C (a) minimum: summer grade oil winter grade oil (b) recommended: summer grade oil winter grade oil (c) maximum allowable temperature for not more than 10 minutes: summer grade oil winter grade oil	25° at all ratings 5° at all ratings from 50 to 80°C at all ratings from 30 to 60°C at all ratings 95° at all ratings 75° at all ratings					
11	Oil temperature at outlet from main gear box, °C recommended: summer grade oil winter grade oil	115° (at all ratings) 115° (at all ratings)					
12	Oil pressure in main gear box: at all ratings on ground and in flight, kg/sq cm* at idling rating, kg/sq cm	3-4.8 not less than 2 kg/sq cm at +60°C inlet oil temperature					
13	Oil temperature in intermediate and tail gear boxes, °C	maximum allowable at all ratings 115					
14	Oil pressure in intermediate and tail gear boxes, kg/sq cm	Not less than 0.5 at idling rating		not less than 2 at all other ratings			

* Oil pressure fluctuation after the main oil pump and the transmission pump is allowed within -0.5 kg/sq cm, provided the pressure in the oil systems of the gear box and transmission is within the permissible limits.

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1	2	3	4	5	6	7	8
15	Oil pressure in free turbine, kg/sq cm	not less than 2 at idling rating				3-4.8 at all other ratings	

- Notes to Table 1:
1. The maximum measured speed of the compressor during engine operation on the ground should be 10,310 r.p.m. (97%);
 2. The free turbine speed (the rotor turbine) is allowed to increase to 8700 r.p.m. (87%) on the ground, and at altitudes up to 3000 m in flight for more than 5 minutes and at altitudes above 3000 m for not more than 60 minutes. The total running time at n_{rot} = 8700 r.p.m. should not exceed 5% of the engine service life.
 3. During the ground adjustment of the collective pitch, throttle control system at a rating of not higher than 45° (by the VMEPT-2 indicator) and at ϕ of the main rotor = 1° (by the VME indicator the free turbine speed may be allowed to decrease for a short time to 7600 r.p.m. for not more than 3 minutes.
 4. During starting and warm-up periods the dancing of the intermediate gear box oil pressure gauge pointer is allowed within the whole range of the scale (even beyond the scale graduations). With the oil warmed up and the engine running steadily the dancing of the pointer is allowed within 0.7 kg/sq cm.
 5. The difference in the gas temperature readings after the engine free turbine indicated by the temperature gauges installed in the pilot's cabin and the flight engineer's cabin is allowed within the following limits: +25°C at up to 0.85 normal ratings; from +50° to -25°C at 0.85 normal rating and higher. The temperature gauge installed in the flight engineer's cabin should be considered the reference gauge.
 6. The difference in readings of the MT3-2 indicators of the left and right engines (the speed of compressors) is allowed within 250 r.p.m. (2.5%). The difference in the indicator readings from the idling rating to 0.66 normal rating as well as for the autorotation conditions is not specified.
 7. At subzero air temperatures the compressor speed at the idling rating is allowed to decrease to 5100 r.p.m. (48.0%) (80 r.p.m. for every 10°C).
 8. When the helicopters are operated at mountain airfields the idling rating speed will be greater than that indicated in the Table. With every 1000 m of elevation of the airfield above the sea level the idling rating speed increases by 150-200 r.p.m.
 9. During long-term test-running of engines or in the course of ground test-running at high temperatures of ambient air (above +20°C) as well as in case of unfavourable location of the helicopter relative to wind when the exhaust gases are thrown towards the intermediate gear box, the maximum oil temperature in the intermediate gear box is allowed to increase to +125°C (at all engine ratings). In this case the light panel EXCESSIVE OIL TEMPERATURE IN INTERMEDIATE GEAR BOX should come on at a temperature of from +108°C to +110°C. The allowable temperature (+125°C) should be checked by the 2TV3-1 indicator.
 10. The oil pressure in the engine and gear box should be adjusted to the following values:
 - (a) in the engine: to a pressure of 3.5-4.5 kg/sq cm at 0.85 normal rating with the oil temperature at the engine inlet of +70°C;
 - (b) in the main gear box: to a pressure of 3.4-4.0 kg/sq cm with the free turbine speed equalling 7800 r.p.m. (78% by the MT3-1 indicator) and the oil temperature of 60°C (in summer) and 40°C (in winter).

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Table 2

Maximum Allowable Temperature of Gas
After Turbine for D-25B Engine
($t_{amb.meas.}$, °C)

t_{amb} °C n.c.t. meas. in % by HT3-2 indicator	Subzero, t_{amb}		Above zero, t_{amb}	
	50 - 21	20 - 0	0 - 20	21 - 50
below 85	440	475	510	560
85 - 90	490	510	540	595
90 - 95	560	570	585	625
95 - 99	630	630	630	630

VI. ENGINE STOPPING

1. Normally the engine is stopped at the idling rating. To effect this, shift the collective pitch-throttle control lever to the extreme lower position (in the course of 10-12 seconds from the take-off rating) and the twist grip - to the extreme left position. As the engine speed decreases check to see that the air blow-off bands should open at $n_{c.t.} = 8300 \pm 100$ r.p.m. ($78 \pm 1\%$) as indicated by flashing of the pilot lamp (the light panel).

2. When the engine starts idling let it run for 2-3 minutes at this speed and then shift the stop cock "KO" to CLOSED position (pull the cock handle).

Note. Prior to stopping the engine (engines) be sure to set the helicopter control stick and trim controls in the neutral position.

3. Measure the inertia rotation time starting from 1000 r.p.m. of the compressor speed. The inertia rotation of the compressor should be not less than 70 seconds and that of the rotor turbine - not less than 90 seconds.

When checking the inertia rotation time make sure that the engine produces no unusual noise and the compressor and turbine rotors revolve smoothly.

4. Make sure that the engine compressors have stopped completely and switch off the fuel booster pumps in the following order:

- set the fuel consumption control switch in MANUAL position if the fuel consumption has been controlled automatically;
- switch off the fuel booster pump if the fuel consumption was controlled MANUALLY.

5. Close the fuel shut-off valves by means of switches located on the flight engineer's panel.

6. If necessary, the engine can be stopped from any rating by shifting the stop cock from the operating position to CLOSED position without gradual reduction of the speed and cooling of the engine at the idling rating. Such stopping procedure should be resorted to in emergency cases only.

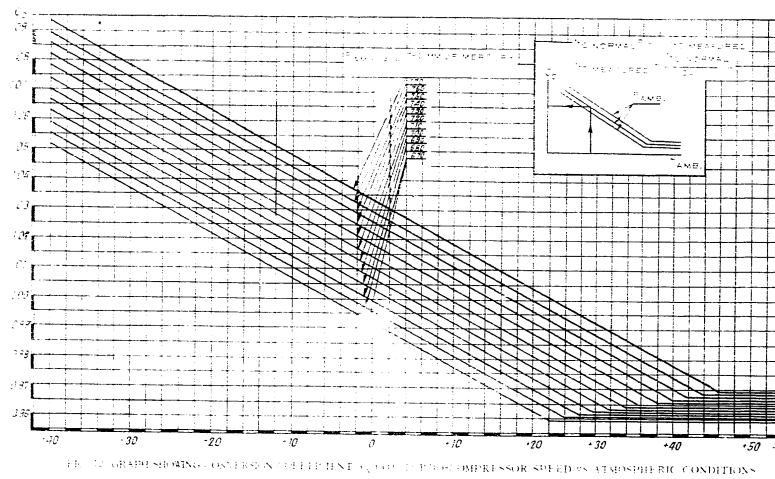
When the engine comes to a standstill, shift the control lever of the HP-23A pump to IDLING RATING position ($15-16^\circ$ by the VHT indicator) and close the fuel shut-off valve.

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The reasons for emergency stopping of the engine may be the following:

- (a) sudden drop of oil pressure at the inlet to the engine, rotor turbine or the gear box;
- (b) great leakage of fuel or oil presenting a fire danger;
- (c) sudden rise of gas temperature after the turbine (beyond the allowable limits);
- (d) long flame torches from the exhaust pipe;
- (e) icing of the compressor intake duct;
- (f) sudden drop of the compressor rotor speed.

Note. Should the stop cock "XO" fail, the engine must be stopped by closing the fuel shut-off cock. If the engine has been stopped by closing the fuel shut-off valve, further use of the HP-23A pump is not allowed. The problem as to further use of the engine after the emergency stopping is decided in cooperation with the representative of the engine manufacturing plant. ©

7. After stopping the engines the main rotor should not be braked, unless necessary. When the main rotor keeps rotating for a long period with the engines stopped, slow it down by a smooth and periodical application of the brake for short periods until it comes to a complete standstill.

8. When the engines are inoperative, the main rotor should be braked so that none of the blades is located above the tail boom or stabilizer.

9. Prior to getting out of the cabin after complete stopping of the engines the crew members should switch off all the circuit breakers and power sources, set the spring feel mechanisms neutral and make sure that the collective pitch-throttle control lever is placed in the extreme lower position and the lever of the main rotor brake in the extreme upper position.

VII. HELICOPTER INSPECTION AFTER TEST-RUNNING OF ENGINES AND TRANSMISSION

1. Immediately after stopping the engines check the nitrogen pressure in the hydraulic accumulator of the main hydraulic system by the pressure gauge. To this end, shift the helicopter control stick and reduce the nitrogen pressure in the main hydraulic system. The pressure gauge reading after which the pointer suddenly drops to zero is the actual charging pressure of the hydraulic accumulators.

2. Inspect the engines, engine units and piping of the oil and fuel systems in the engine compartment. See that there is no leakage in pipe connections and units of the fuel and oil systems.

3. See that there is no fuel leakage on the bottom skin of the fuselage.

4. Inspect the hydraulic ^{hydraulic assembly} boosters, piping and the panels of the hydraulic systems. See that there is no leakage in pipe connections and make sure that they are reliably fixed in split blocks and clamps.

5. Check the oil level in the oil tanks of the engines and the main gear box.

6. Check the drain valves of the oil and fuel systems for proper locking.

7. Check condition of the engine air intakes and the fan and condition of the engine control link-rods.

8. Inspect the end fittings of the vent piping of the fuel and oil systems in the gear box compartment and on the outer side of the fuselage. Make sure they are clean.

9. Inspect the main rotor hub and the swashplate. Make certain there is no visible damage to parts and oil leakage from hinges and dampers.

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VIII. PRE-TAKE-OFF INSPECTION

1. Switch off the engines and the helicopter mains.
 2. See that there is no leakage of hydraulic fluid, oil and fuel on the fuselage skin and the engine cowls.
 3. Inspect the main and tail rotors from the ground and make sure that they are free from visible damage.
 4. Inspect the landing gear (examine it very thoroughly in case of hard landing).
 5. Check to see that the helicopter tanks are filled sufficiently with fuel and oil for the fulfilment of the expected flight mission.
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Chapter II

POST-FLIGHT OPERATIONS

The post-flight operations on the helicopter are performed at the end of the flying day.

All the detected troubles should be corrected after fulfillment of the post-flight inspection.

I. PRELIMINARY OPERATIONS

1. Upon taxiing the helicopter to the parking ground, stop the engines, switch off the storage batteries and close the fuel shut-off valves.
2. Switch off the toggle switch of the PA-74M/7 valve of the main hydraulic system before the pressure in the system starts dropping.
3. Ground the helicopter.
4. Have the crew members report all the troubles noted in flight.
5. Drain off sediment from the bowl of the air system filter.
6. Service the helicopter with fuel and oil.
7. Release the retractable work platforms of the engine and gear box compartments, open cowls, doors and access panels for inspection of the helicopter. (U)
8. Clean the helicopter from dust and dirt.

II. POST-FLIGHT INSPECTION

The inspection and checking of the helicopter should be performed in conformity with the walk-around procedure illustrated in Fig.13. When doing so, perform the following operations:

(1) Engines and Fan Unit

1. Measure the inertia rotation time of the compressor rotor after the engine is switched off.
2. Inspect the engine intakes and make sure that there are no punctures, dents, loose rivets and foreign objects.
3. Check condition of the engine accessories, reliability of their attachment, condition of locking devices and tightness of joints.
4. Inspect the engine cowls and see that they are neither cracked nor dented.
5. Inspect the fittings attaching the engine to the helicopter.
6. Check the high-pressure piping of the engine fuel system for leakage and reliability of attachment.

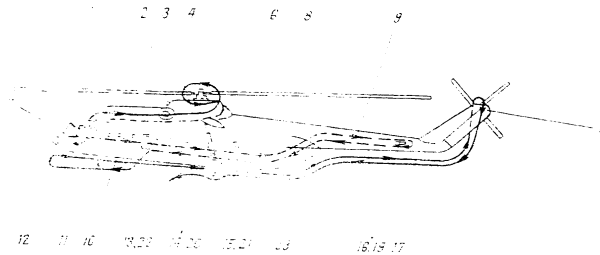
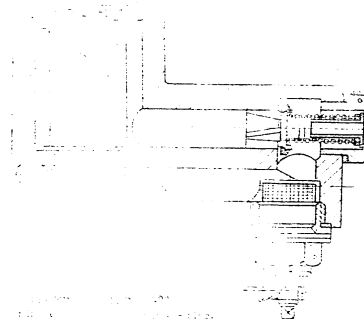
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7. Check attachment of the piping, condition and tightness of the connections of the fuel and oil systems.
8. Check the control link-rods and bell cranks of the HF-23 power selector, engine selector control levers, make sure that the control links are not bent and there is no excessive play. (2)
9. Check condition of the oil coolers of the engines and the main gear box and see that there is no oil leakage through honeycomb tubing, cooler tanks and joints.
10. Check condition of the fan shaft and shrouds of the engine drive shafts.
11. Using a portable lamp check the interior of the shrouds of the engine free turbine and see that they are free from cracks or burnt places.
12. Using a portable lamp, inspect the blades of the free turbine gear case and make sure that they are not cracked, burnt or otherwise damaged. Check condition of the exhaust pipes.
13. Check the quantity of oil in the engine oil tanks and, if necessary, top up the tanks, bearing in mind that when the oil is hot the indicators show a greater amount of oil than under normal conditions.
14. Check condition of the fire extinguishers, discharge bonnets and the piping of the fire fighting system. Using a pressure gauge check the pressure in the extinguishing bottles.

(2) Main Gear Box Compartment

1. Inspect the braces and attachment fittings of the gear box mount. See that there are no cracks on welded joints of the braces. Using a portable lamp, and a magnifying glass X6-10, inspect the fittings through the access panels located in the front section of the gear box cowl.
2. Check the oil level in the main gear box.
3. Check the tightness of the gear box oil system, attachment of the piping, condition and tightening of the durite connections.
4. Make sure that the pipe joints of the 30-23 filters are not leaking and show no oil leakage. Every 10-15 hours of flying inspect the filters and their cleanliness as follows: unlock and turn off plug A (Fig. 14) extract plug A, withdraw filter element 2, inspect and make sure that there is no dirt or oil and damage. After inspection wash filter element 2 with kerosene and reinstall.
5. Check condition of the hydraulic boosters, accessories, and the entire hydraulic system. Check all joints for tightness and reliability of the system. Coat the rods of the hydraulic boosters with a thin layer of grease.

6. Check the fluid level in the hydraulic reservoir.
7. Inspect the vent pipes of the fuel system protruding from the gear box compartment and see that they are free from dirt, clogging or damage.

(3) Main Rotor Hub and Swashplate

1. Inspect the main rotor hub and swashplate and make sure that they are not damaged. See that there are no cracks on the welded joints of the swashplate, especially on the top and bottom surfaces adjacent to the control linkage of the main rotor blades.
2. Inspect the shackle, guide lever, control rods and bell crank levers of the swashplate and make sure that they are not cracked.

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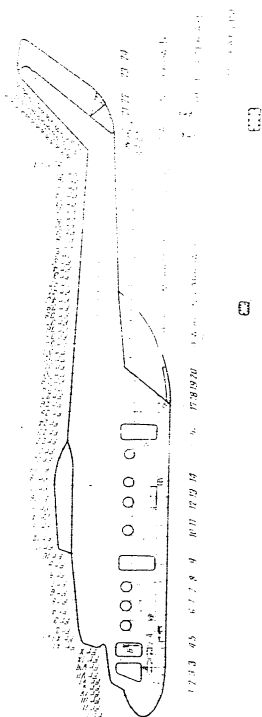


FIG. 15. LAY-OUT OF ACCESS PANELS, HATCHES, AND DOORS ON TAIL FIN (FROM SIDE)

1 — pilot's emergency exit door; 2 — panel for access to linkage of controls; 3 — storage battery box; 4 — radio operator's emergency exit door; 5 — receptacle for V-200 fuel for connection plug of ground A.C. power supply; 6 — receptacle for V-200 fuel for connection plug of ground D.C. power supply; 7 — bay for storage of tie-down wire rope; 8 — hatch for helicopter landing; 9 — cargo compartment door; 10 — bay for storage of tie-down cable; 11 — bay for storage of life belts; 12 — open bay for release of exhaust gases of turbine engines; 13 — charging hatch for hydraulic and air systems of helicopter; 14 — bay for release of exhaust gases of external fuel tank; 15 — hatch for charging pneumatic of helicopter oxygen system; 16 — cargo compartment door; 17 — hatch for fuel draining from non-return valve and for servicing its pump system; 18 — control panel of cargo ramps and loading doors; 19 — cargo ramp; 20 — cargo compartment of rear loading doors; 21 — access hatch to tail fin; 22 — lower access hatch for tail fin; 23 — access hatch for tail fin; 24 — access hatch for tail fin.

tail light wiring

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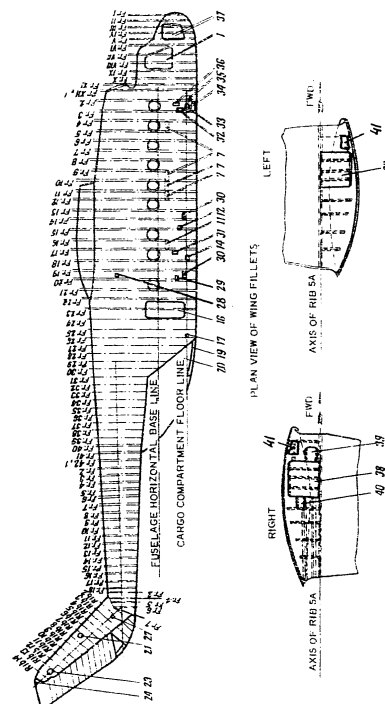
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FIG. 16. LAY-OUT OF ACCESS PANELS, HATCHES, AND DOORS (STARBOARD)

1 - pilot's emergency exit door; 7 - bay for storage of tie-down wire ropes; 11 - bay for storage of life belts; 12 - opening for release of exhaust gases of airborne vehicles; 16 - rear door of cargo compartment; 17 - hatch for fuel draining from non-return valve and for servicing hydraulic system; 19 - cargo ramp; 20 - cargo compartment rear loading doors; 21 - access hatch for inspection and lubrication of shaft tail support; 23 - access hatch for servicing tail shaft and draining oil from tail gear box; 24 - access hatch for tail gear box oil filler; 27 - hatch for filling oil in intermediate gear box; 28 - access panel for inspection of attachment fittings of fuel transfer pipe; 29 - access panel for drain valve of 4th and 5th tank groups; 30 - access hatch for attachment of vent and inert gas piping; 33 - access hatch for attachment of piping and helicopter fuelling set; 34 - access panel of three-way valve of inboard refuelling equipment; 35 - access hatch for attachment of piping to inboard refuelling equipment; 36 - filler neck hatch for filling fuel into 1st and 2nd tank groups; 37 - navigator's door; 38 - access panel for inspection of fuselage attachment (trunks); 39 - access panel of FMA-1 unit; 40 - access panel of fuel system; 41 - access panel for inspection of gear box frame.

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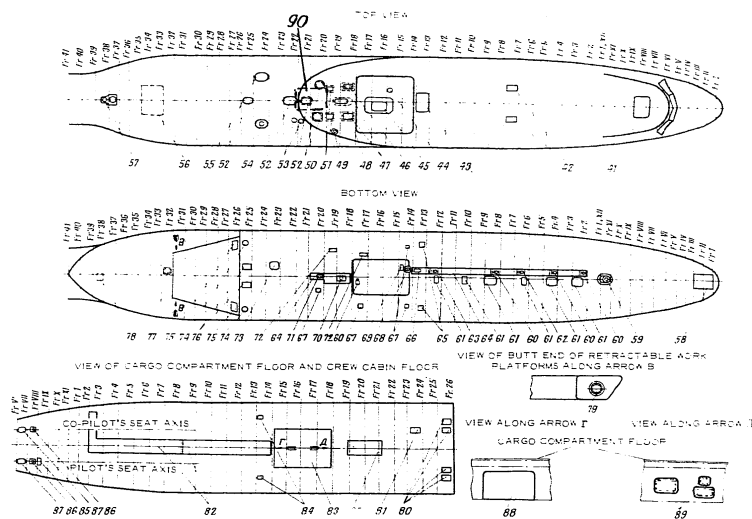


FIG. 17. LAY-OUT OF SERVICE DOORS, ACCESS PANELS AND HATCHES (TOP, BOTTOM, CARGO COMPARTMENT FLOOR, AND PILOT'S CABIN FLOOR VIEWS)

41 - engine access hatch panel; 42 - access hatch for engine thermocouple; 43 - access hatch for inspection of engine transmission and fan unit; 44 - oil drain from gear box; 45 - hatch for inspection of gear box compartment and access to rotor slip rings; 46 - panel in ceiling skin for servicing fire fighting system; 47 - bay for (115/60) generator; 48 - hatch for passage of transmission shaft; 49 - hatch for passage of fuel system piping; 50 - panel for access to top plate of tank No. 11; 51 - hatch for attachment of fuel piping; 52 - access panel for inspection of transmission shaft supports; 53 - filler necks of 5th and 4th fuel tank groups; 54 - panel for access to top plate of tank No. 10 and fuelling valve of 4th group; 55 - panel for access to top plate of tank No. 9; 56 - manhole plate in fuselage tail section; 57 - panel for access to directional transmitter of JAK-B unit; 58 - doors of special equipment compartment; 59 - hatch for L.G. nose leg; 60 - hole in removable panel for draining sediment from non-return valves; 61 - panel for access to fittings attaching fuel piping to bottom plates of lower tanks; 62 - fuel drain from 1st tank group (fuel tanks 2 and 3); 63 - fuel drain from 2nd tank group; 64 - removable panels for access to fuel system units and piping; 65 - panels for access to joints of heating system piping; 66 - hatch for attachment of fuel system piping and for draining fuel from lower tanks; 67 - hatch for attachment of air system and fuel system piping; 68 - panel for draining fuel from lower tanks; 69 - panel for access to fuel drain valve; 70 - panel for access to fuelling valve of 3d tank group filled by inboard refuelling equipment; 71 - hatch for draining fuel from 3d tank group; 72 - hatch for attachment of transfer piping and access to auxiliary tank; 73 - WPII-5611 set inboard aerial; 74 - panel for inspection of connections of hydraulic system piping; 75 - panel for access to hydraulic hoses; 76 - panel for access to joints of hydraulic system piping; 77 - hatch for replacement of hydraulic lock bolts; 78 - panel on frame lug for inspection of hydraulic cylinders of cargo compartment loading doors; 79 - panel for attachment and inspection of actuating cylinders of work platforms; 80 - panel for access to hydraulic system actuating ramps; 81 - panel for access to receiver and WPII-5611 set inboard aerial; 82 - removable panels for access to fuel system units and piping; 83 - central hatch in cargo compartment floor; 84 - panel for access to joints of heating piping; 85 - hatch for attachment and inspection of control system spring feel mechanisms; 86 - hatch for lifting cylinder of pilot's seat; 87 - panel for inspection of control column; 88 - panel for access to spring-type damper, piping of fuel, hydraulic and fire fighting systems as well as valve for fuel draining from lower tanks; 89 - panel for access to fuel system piping; 90 - Access hatch in cowling for inspection of hydraulic assembly.

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Coat the steel lugs of the rods with a thin layer of HMATM-201 grease.

3. Check all the nuts, bolts, and other joints of the hub and swashplate for proper locking.

4. Check tightness of the flapping, drag, and feathering hinges. If oil leakage is detected during inspection it is necessary to check the oil level in these hinges and supplement them with oil.

5. Check the fluid level in the compensating tank; make sure that there is no fluid leakage in the hydraulic dampers and the compensating system.

6. See that there is no play in the left control stick; to do this, fix the right control stick by means of a set pin and try to shift the left control stick in the longitudinal direction. If a play of about 20 mm is detected during this check (as measured at the end of the control stick) and the play is accompanied with a specific jerk when the stick is being shifted from the initial position correct the trouble as follows: tighten up the nuts of the taper set bolts of the left control stick brackets and lock them anew.

(4) Main Rotor Blades and Wing (top view)

1. Inspect the root sections of the spars.

2. Inspect the attachment screws of the nose and tail sections of the blade, blade root fairing and tip. See that the screws are neither loose nor broken.

3. Check attachment of the sections to the spars by trying to turn the section with respect to the spar, applying a light pressure on the trailing end by hand. In this case displacement of one section relative to the other (as measured by the trailing edges) is allowed within 6 mm.

4. Inspect the nose and tail parts of the blade sections and see that the skin is not damaged and the riveted joints are in good condition. Check presence of gaps between the rear edges of the sections.

Note. Inspect the blades (Dwg B2700-00) in compliance with Para.4, make sure that the skin is not bulged and the glued joints are in good condition. If defects are found in glued joints, remove the blade (blades) from the helicopter, place it (them) on trestles and determine the degree of damage. The quality of glueing is checked by striking the skin of the tail sections with a 10-15 gr plastic hammer having a spherical head. The defects are traced aurally. Non-glued areas should be recorded in a special Chart.

(1) The defective glued joint between the nose portions of the blade sections and the tail ones is tolerable within 20% of the total length of the glued seam.

(2) The defective glued joint between the tail section skin and the honeycomb filler is tolerable within the limits indicated in the Chart (Fig. 19).

(3) The defective glued joints between the skin and the tail stringer in any spot should not exceed 100 mm in each blade section.

The total length of the defective glued joints between the stringer and the skin is allowed within 200 mm in each blade section. All defective glued joints between the stringer and the skin should be recorded in the respective Chart.

5. Inspect the exterior of the wing, make sure that the skin is not damaged or deformed and see that the riveted seams are in good condition.

6. Inspect the top skin of the fillet and the wing and see that there are no signs of corrosion due to the effect of hot gases expelled from the engines.

(5) Crew Cabin

1. Inspect the glass panels and glass wipers. Check condition of the locking device on the door jettisoning handles.

2. Inspect the nose strut-to-fuselage attachment fittings.

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CONFIDENTIAL(6) Cargo Compartment

1. Inspect the piping and accessories of the fuel system mounted on the cargo compartment ceiling, make sure that they are leakproof and that the attachment clamps of durite connections are reliably tightened.
2. Inspect the piping of the hydraulic system. See that there is no leakage of fluid and the pipe connections are properly locked.
3. Inspect the control link rods and bell cranks in the cargo compartment, make sure that the link rods and bell cranks are not damaged, the locking devices of the hinged bolts are in good condition and there is no play in the joints.
4. Inspect the attachment fittings of the removable panels of the cargo compartment floor, make sure that there are no missing screws for attachment of the panels and see that the screws are driven fully home.
5. Inspect the bottom doors of the cargo compartment and see that they are not damaged.
6. Inspect the entry door, rear loading doors and ramps; make sure that they are not damaged.
7. Check condition of the access panels, reliability of their closing and functioning of fasteners.

(7) Fuselage, Landing Gear, Wing (Bottom Side)
and Tail Boom (Exterior)

1. Inspect the exterior of the fuselage. See that there are no cracks, dents, residual deformation and damage to the riveted seams of the skin.
2. Make sure that there are no traces of leakage of fuel, oil, and AMT-IO fluid from the helicopter systems.
3. Inspect the tail boom skin, check condition of the stabilizer and its attachment fittings.
4. Inspect the tail bumper and make sure that there is no leakage of AMT-IO fluid along the shock-absorber strut.
Inspect the shock strut of the L.G. nose leg, make sure that there is no leakage of AMT-IO fluid along the inner tube and check the wheels for proper attachment. After hard landing check the shock strut with the wheels removed.
5. Inspect the external fuel tanks for mechanical damage, fuel leakage and loose attachment fittings. Check cleanliness of the vent piping.
6. Inspect the main landing gear. Make sure that the charging pipe unions are leakproof and there is no leakage of fluid along the shock strut inner tubes. Inspect the wheel tyres for cracks or cuts on the tyre rubber. Check the tyres inflation by their deflection. After hard landing inspect thoroughly the landing gear with the wheels removed.⑩

(8) Tail Boom, Tail and Intermediate Gear
Boxes and Tail Rotor

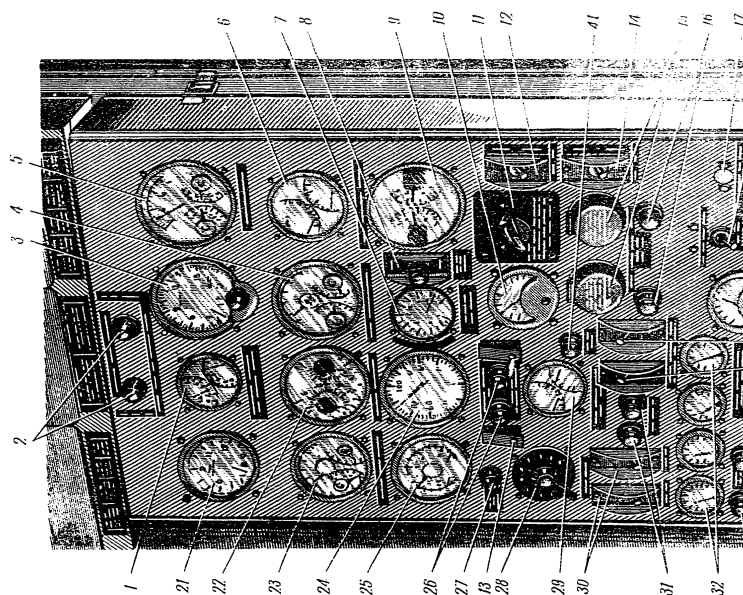
1. Check the oil level in the tail and intermediate gear boxes by means of oil dipsticks. If necessary, replenish oil. (The oil level should be located between the upper and the lower mark lines of the oil dipstick). Check the gear boxes for proper attachment.
2. Inspect condition of the tail gear box driven shaft and the fittings attaching the tail rotor to the shaft; make sure that there are no cracks on the hollow chamfer of the shaft.

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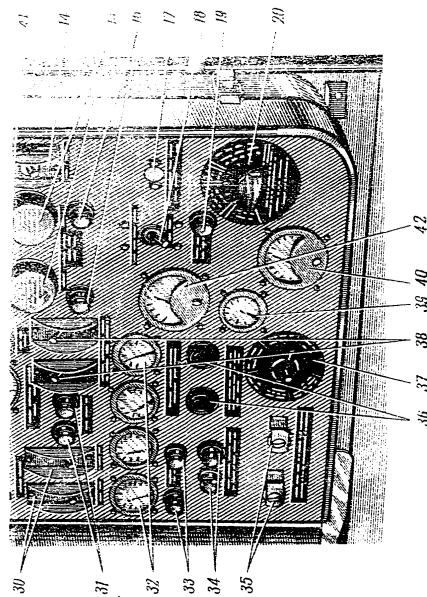


FIG. 18. FLIGHT ENGINEER'S INSTRUMENT BOARD

1 - free turbine oil pressure indicator; 2 - lights indicating chips in transmission oil; 3 - flowmeter indicator; 4 - right engine three-point indicator; 5 - gear box three-point indicator; 6 - intermediate and tail gear box oil pressure indicator; 7 - fan vane position indicator; 8 - fan vane control switch; 9 - intermediate and tail gear box oil temperature indicator; 10 - voltmeter (10-250); 11 - phase check switch; 12 - fan switch; 13 - air blow-off band control circuit switch; 14 - lighting switch; 15 - A.C. generator voltage adjustment external resistors; 16 - A.C. generator failure warning lights; 17 - 100-1500 inverter voltage adjustment rheostat; 18 - GENERATORS - 100-1500 INVERTER selector switch; 19 - 100-1500 inverter failure warning light; 20 - de-icing system check switch; 21 - flowmeter indicator; 22 - exhaust gas temperature indicator; 23 - left engine three-point indicator; 24 - engine speed indicator; 25 - flowmeter indicator; 26 - air blow-off band indicating lights; 27 - fuel low level warning lights; 28 - fuel quantity gauge switch III; 29 - indicator showing fuel pressure before HP-23 pump; 30 - D.C. generator switches; 31 - ground power supply indicating lights; 32 - ammeter; 33 - generator failure warning lights; 34 - 4311-BN unit CLOSED warning lights; 35 - D.C. generator voltage adjustment external resistors; 36 - storage battery voltage check switch; 37 - D.C. voltage check switch; 38 - ground supply switch and "MAINS FED FROM STORAGE BATTERY" switch; 39 - D.C. voltmeter; 40 - ammeter (10-300); 41 - storage battery failure warning light; 42 - voltmeter (100-150).

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3. See that there is no mechanical damage and cracks on the tail rotor hub and blades.
4. Make sure that there is no play and binding in the rotor hub hinges.

III. MAINTENANCE OPERATIONS PERFORMED DURING POST-FLIGHT INSPECTION

A. Every 10¹⁵ Flying Hours

1. Inspect the blades of the fan unit (the adjustable blades and the blades of the fan rotor) for cracks and dents. See that the adjustable blades turn smoothly and the fan rotor produces no unusual sounds when being revolved.
2. Check condition of the flight control link rods and bell cranks and their hinges.
3. Check condition of the stabilizer and tail rotor control wire ropes and see that the wires are neither broken nor burred.
4. Inspect the flight and engine control link rods and bell cranks located below the crew cabin floor.
5. Check the L.G. nose strut-to-fuselage attachment fitting.
6. Open the protective panels on the ceiling and the front wall of the cargo compartment. Inspect the flight and engine control link rods and bell cranks. Make sure that there is neither excessive play in the hinged joints nor excessive wear of the link rods due to contact with their guide rollers. See that there is no excessive play and wedging between the guide rollers and link rods. Make sure that the panel attachment fasteners are in good condition. (C)
7. Check functioning of the mechanisms for opening the loading doors and ramps, inspect condition of the hydraulic locks, tight closing of the doors and make sure that the piping is leakproof.
8. Inspect the control wire ropes of the tail rotor and stabilizer for sagging, fretting and breakage of wires.
9. Inspect attachment fittings of the stabilizer, check condition of the spar and worm gear mechanism, make sure that there is no play in the splined joint of the worm mechanism and see that there are no cracks on the spar and attachment fittings.
10. Check pressure of nitrogen in the nose shock strut by its compression (closure). Check pressure in the wheel tyres by means of a pressure gauge. (C)
11. Check the main landing gear-to-fuselage attachment fittings. Check air pressure in the wheel tyres by means of a pressure gauge. Check pressure of nitrogen in the shock struts of the main landing gear by their compression. (C)
12. See that there is neither excessive play nor binding in the rotor hub hinges.
13. Inspect the retractable work platforms and covers of the cowls for cracks and dents. Check the work platforms-to-fuselage attachment fittings and condition of the hydraulic dampers.

Note. Every 5 flying hours drain off the oil from the engines through the drain valve installed in the lower accessories drive gearbox and inspect the oil filters upstream of the engine.

B. Every 25¹⁵ Flying Hours

1. Check the CN-6 spark plugs for tightening.
2. Check condition of the braces and fittings attaching the fan unit to the fuselage.

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3. Inspect the ventilation trunks and cargo compartment hot air trunks for cracks or dents and make sure that they are properly fastened. Check functioning of the shutter of the crew cabin heating system.

4. Drain off 2-3 litres of oil from the gear box oil sump through a funnel furnished with screen No.24.

5. Screw off the plugs and drain sediment from the coarse filters through a silk cloth filter. (C)

6. Inspect the seat adjustment mechanisms and hydraulic piping and the friction clutch of the collective pitch-throttle control lever for leakage in joints, fretting and mechanical damage to the piping.

7. Inspect and check the external cargo sling system, paying attention to the following:

- tightening and locking of the joints;
- easy rotation of the swivel lock in the bearings;
- absence of leakage through the hydraulic cylinder pipe unions and along the actuating rod when there is no positive pressure in the cylinder.

8. Check condition of the frames, stringers, skin, bolted joints of the tail boom, fin beam and the fuselage.

9. Check condition of the transmission tail shaft and reliability of attachment of its supports to the frames. Make sure that there is no oil leakage through splined joints.

10. Inspect the glass panels and attachment of doors in the fuselage nose portion.

11. Check condition of the inboard refuelling equipment, three-way valve and joints of the fuel piping. Make sure that the system is leakproof.

12. Make sure that the cocks of the spring-type damper are open, properly locked and leakproof. See that the small pipe unions on the damper casing are reliably tightened.

13. Inspect the tail bumper and make sure that there is no fluid leakage along the shock-absorber system, see that the tail bumper attachment fittings are in good condition.

14. Open the access panel in the pylon and inspect the wire ropes and the roller-plate chain of the tail lever control system.

Inspect the tail shaft of the transmission and its joints with the gear boxes.

15. Check attachment of the tail gear box to the fin beam and see that there are no cracks on the gear box flange.

16. Inspect the main oil filter of the gear box and wash it with kerosene or gasoline.

17. Turn off the P-7 magnetic plugs, inspect them, wash and install in place.

18. Inspect and wash the 40-23 chip-detecting filters, reinstall the filters.

19. Drain the oil from the engine through the drain valve mounted on the lower accessories drive gearbox.

Inspect the oil filter installed at the inlet to the engine and wash it with clean gasoline or kerosene.

20. Inspect and lubricate the rods of the hydraulic boosters as follows:

- (a) wipe both ends of the actuating rod with a dry cloth;
- (b) coat the rods with a thin layer of **LIATUM-20I** grease.

21. Perform the operations under Paras 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 of the subsection "Every 10th Flying Hours". (C)

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11. Inspect connections of the wire ropes. Make sure that the wire ropes are not chafed and have no broken or corroded wires. After inspection wipe the wire ropes with a clean cloth and coat them with a thin layer of MF-50 grease. Meanwhile make sure that the rollers are in good condition and rotate easily.

Notes: 1. Every 10th and 25th flying hours lubricate the accessories as indicated in the Table and the Lubrication Chart.

2. If the inspection includes maintenance work on elimination of leaks and adjustment of engine accessories, the engines should be started to make sure they function properly and that all joints are leakproof.

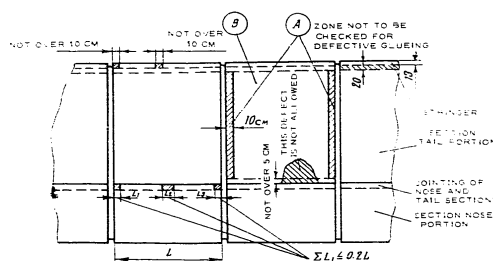


FIG. 10. TOLERABLE DEFECTS IN BLADE GLUED ATTACHMENTS.
Zone A - defective glueing is tolerable within 500 sq cm area max.
for sections 1-6 and within 350 sq cm area max. for sections *-20.
Zone B - defective glueing is tolerable within 1000 sq cm area.
Total area of defective glueing in zones A and B is tolerable within
1200 sq cm for sections 1-6 and within 1000 sq cm for sections *-20.

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Chapter III

SERVICING HELICOPTER SYSTEMS

1. TABLE OF HELICOPTER CONTAINERS

Nos	Container	Full capacity, litres (by dwg)	Quantity to be filled		Note
			lit	kg	
1	2	3	4	5	6
1	<u>Fuel system</u>				1. Quantity of fuel to be filled is indicated without non-drainable remainder
	<u>A. Group I</u>				
	Tank No.1		465	360	
	Tanks Nos 2 and 3		940	725	
	<u>B. Group II</u>				
	Tanks Nos 4, 5 and 6		1420	1100	2. Specific weight of fuel is assumed to be 0.775
	<u>C. Group III</u>				
	Tanks Nos 7 and 8		870	673	
	<u>D. Group IV</u>				
	Tanks Nos 9 and 10		2700	2090	
2	<u>E. Group V</u>				1. Oil system of each engine contains 36 lit of oil
	Tank No.11		1760	1365	
	<u>F. External tanks</u>				
	Right tank		2250	1745	
	Left tank		2250	1745	
	<u>Oil system</u>				
	(a) Left engine oil tank	35	23	-	
	(b) Right engine oil tank	35	23	-	
	(c) Main gear box	-	215-235	-	Cut of total oil quantity (215-235 lit) contained in
	(d) Intermediate gear box	-	7	-	

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1	2	3	4	5	6
	(e) tail gear box		26		main gear box, 65 lit are kept in external system, of which 40 lit in oil coolers
3	<u>Hydraulic system</u>				
	(a) Hydraulic reservoir of main system	67 $\pm$ 2	45	-	1. Hydraulic system contains 115 lit of fluid
	(b) Hydraulic reservoir of duplicating and auxiliary systems	67 $\pm$ 2	45	-	2. Air space of hydraulic accumulators is filled with nitrogen to following pressures:
	(c) Air space of hydraulic accumulators				
	- main system	2x12,25	-	-	85 $\pm$ 5 kg/sq cm
	- duplicating system	1x12,25	-	-	85 $\pm$ 5 kg/sq cm
	- auxiliary system	1x12,25	-	-	30 $\pm$ 2 kg/sq cm
4	<u>Air system</u>				
	Air bottles (in shock struts)	2x32	-	-	50 kg/sq cm pressure
5	<u>Oxygen system</u>				
	(a) Stationary oxygen bottles	3x4	-	-	150 kg/sq cm pressure
6	<u>Shock struts</u>				
	(a) Air chamber of main leg shock strut				Shock struts are filled with nitrogen to following pressures:
	- high-pressure chamber	-	2x23	-	48 $\pm$ 1 kg/sq cm
	- low-pressure chamber	-	2x4.8	-	14 $\pm$ 0.5 kg/sq cm
	(b) Air chamber of nose shock strut	-	1x6	-	27 $\pm$ 1 kg/sq cm
	(c) Air chamber of tail bumper	-	1x2.35	-	60 $\pm$ 1 kg/sq cm
7	Hydraulic dampers of main rotor hub and compensating system	-	2.5	-	Charging is performed with strut inner tubes fully extended See Section VII

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II. HELICOPTER FUELLING

(1) Preliminary Preparation

1. The *Mu-6* helicopter powered by the *A-25B* engines should be operated on kerosene, grade TC-1 (FOCT 7149-54) or grade T-1 (FOCT 4138-49). Mixing of the above grades of fuel during the helicopter refuelling is allowed.
 2. Check the quality of the delivered fuel by the Certificate and make sure that the latter contains permission for use of the particular fuel.
 3. Prior to fuelling, reliably ground the helicopter and the refuelling truck.
 4. Check presence of cap seals on the refuelling truck and condition of dispensing gun strainers.
 5. Drain off some quantity of fuel from the bowl of the refuelling truck and make sure that it is clean.
Drain off 1-2 litres of fuel through the dispensing gun into a clean vessel. Make sure that the fuel is clean.
- CAUTION. If the fuel drained off from the bowl of the refuelling truck or the dispensing gun contains mechanical impurities, alkaline mud or water, do not start the fuelling procedure and report the trouble to the engineer.
6. Check to see there are necessary fire fighting means near the helicopter.

(2) Fuelling

The fuel tanks of the helicopter may be filled as follows:

- (a) by the refuelling truck;
- (b) by the inboard refuelling equipment.

A. Fuelling of Helicopter by Refuelling Truck

1. Fuelling of the helicopter from the refuelling trucks is checked by the flight engineer (flashing up of white pilot lamps on the flight engineer's panel) or by a person who performs the fuelling and stands at the filler neck of each group of tanks (the full level of fuel is indicated by flashing of the light panel near the filler neck). When the lamps (or the light panel) come on, stop feeding fuel to the particular group of tanks.

Note. In special cases it is allowed to top up the tanks of groups I, II, III, IV with additional 90-100 litres of fuel for each group after the fuelling pilot lamps come on. In this case the pump of the refuelling truck should run at as slow rate as possible.

2. Upper fuel tanks Nos 9, 10, and 11 are filled through two filler necks located on top of the fuselage central portion (Fig.20). In this case tank 9 is filled from tank 10.

When fuelling upper tanks the fuelling hose should be lifted by means of a sling stowed in the bay of the gear box cowl access panel.

3. Lower fuel tanks are filled as follows:

- (a) tanks Nos 1, 2, and 3 - through the rear filler neck located on the starboard of the fuselage between frames 2 and 3 (Fig.20);
- (b) tanks Nos 4, 5, and 6 - through the front filler neck located on the same side (Fig.20).

Note. Tanks of groups I and II are fuelled through two filling tubes - one for each group. All tanks are provided with interconnecting tubes;

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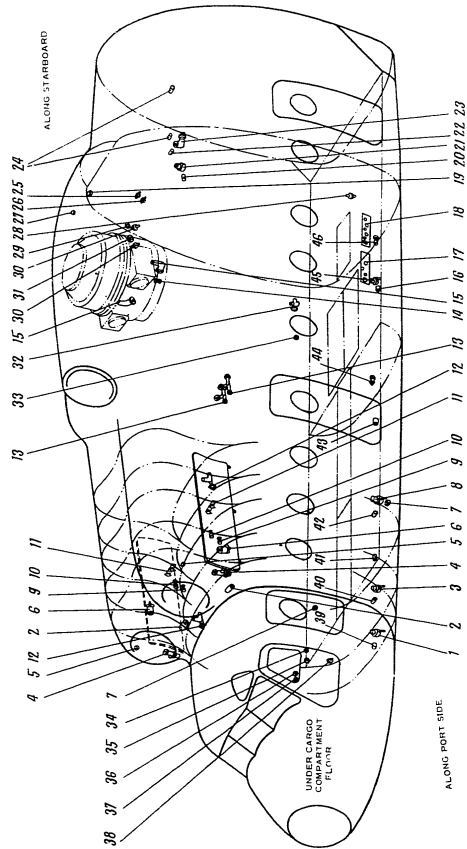
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FIG. 20. LAY-OUT OF FILLING AND DRAINING POINTS LOCATED ON HELICOPTER PORT SIDE

1 - booster pump of reserve fuel tank No. 11; 2 - valve for draining sediment from coarse filter (port side and starboard); 3 - oil tank filler neck (port side and starboard); 4 - valve for draining sediment from coarse filter (port side and starboard); 5 - oil tank filler neck (port side and starboard); 6 - valve for draining sediment from coarse filter (port side and starboard); 7 - oil tank filler neck (port side and starboard); 8 - booster pump of reserve fuel tank No. 11; 9 - valve for draining sediment from coarse filter (port side and starboard); 10 - valve for draining oil from engine feed pipe (port side and starboard); 11 - valve for draining oil from engine feed pipe (port side and starboard); 12 - valve for draining sediment from engine feed pipes (port side and starboard); 13 - plug for draining oil from oil pipe, channel of free turbines to main gear box (port side and starboard); 14 - valve for draining oil from main gear box; 15 - main gear box filler neck (port side and starboard); 16 - valve for draining sediment from non-return valve of fuel tank No. 7; 17 - air system panel; 18 - helicopter hydraulic system panel; 19 - filler neck of hydraulic fluid reservoir of auxiliary and duplicating systems; 20 - valve for draining sediment from non-return valve of fuel tank No. 11; 21 - booster pump of fuel tank No. 9; 22 - valve for draining sediment from non-return valve of fuel tank No. 9; 23 - booster pump of fuel tank No. 9.

FILLING AND DRAINING POINTS LOCATED ON HELICOPTER STARBOARD

24 - valve for draining sediment from non-return valves installed on interconnection piping of fuel tanks No. 9 and No. 10; 25 - vent pipe of fuel tank No. 9; 26 - drain pipe of fuel tank No. 11; 27 - pump sealing gland; 28 - filler neck of hydraulic fluid reservoir of main system; 29 - pipe for draining sediment from non-return valves of upper tank groups; 30 - filler neck of upper fuel tank No. 10; 31 - pipes for draining fuel from filler necks of fuel tanks Nos. 10 and 11; 32 - valve for draining fuel from upper fuel tanks; 33 - filler neck of 3d fuel tank group; 34 - pipe-union for ground fuel supply to tanks and filling, and tank group by means of onboard refueling equipment; 35 - pipe-union for fuel supply from tanks carried in cargo compartment; 36 - filler neck of 1st fuel tank group; 37 - filler neck of 2nd fuel tank group; 38 - pipe-union for fueling from ground tanks.

DRAINING POINTS LOCATED UNDER CARGO COMPARTMENT FLOOR

39 - valve for draining sediment from non-return valve of fuel tank No. 1; 40 - valve for draining sediment from non-return valve of fuel tank No. 2; 41 - valve for draining fuel from 1st fuel tank group; 42 - valve for draining sediment from non-return valve of fuel tank No. 4; 43 - valve for draining fuel from non-return

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(c) tanks Nos 7 and 8 are filled through the filler neck of tank 7 located on the starboard side of the fuselage between frames 17 and 18 (Fig.20), tank 8 being filled through tank 7.

4. External tanks are filled through their respective filler necks located in the nose parts of the tanks near the front stressed frame.

CAUTION. To prevent overflow of fuel through the filler necks and vents, the remaining 150-200 litres of fuel are supplied into each group of tanks with the pumps of the refuelling truck operating at slow speed.

B. Helicopter Servicing by Inboard Refuelling Equipment.

1. Fuelling of the helicopter by the inboard refuelling equipment should be checked by the flight engineer. Flashing of white pilot lamps on the flight engineer's control panel indicates that the tanks are full.

In the course of fuelling the external tanks the flight engineer should keep a close watch at a white pilot lamp with stencilled sign EXTERNAL (ПОДВЕХ.) on his control panel.

Since the check of the fuelling procedure of group III (tanks 7 and 8) by the light panel located near the filler necks presents some difficulty when the external tanks are attached in place, it is recommended to check the fuelling of the tanks of group III only by the white pilot lamps located on the flight engineer's panel.

2. To provide for fuelling of the helicopter in field conditions (when no refuelling truck is available) the helicopter is provided with inboard refuelling equipment located under the access panel (between frames 2 and 3) below the filler necks of group I and II tanks at the starboard of the helicopter.

3. The helicopter refuelling equipment should be energized by the ground power supply source to avoid discharge of the helicopter storage batteries.

4. In exceptional cases when the ground power supplies are not available and when the helicopter storage batteries are charged normally it is allowed to switch on the refuelling equipment from the electrical circuit of the helicopter for not more than 20 minutes (this period is sufficient for filling 2400 litres of fuel).

CAUTION. In this case the period of power supply for energizing the fuelling pilot lamps should be as short as possible. The circuit of the pilot lamps should be energized only before the beginning of the fuelling operation so as to determine the fuel quantity in the tanks and 3-5 minutes before the end of the fuelling operation to make sure that the tanks are full.

5. Filling of fuel tanks Nos 1, 2, and 3 by means of the refuelling equipment is carried out in the following sequence:

- (a) connect a swing hose to the receiving pipe union of the refuelling equipment and insert the other end of the hose into the ground tank;
- (b) open the central valve mounted on the housing of the refuelling equipment for fuelling tanks Nos 1, 2, and 3;
- (c) fill the hose running from the ground tank to the pump with fuel;
- (d) turn on the toggle switch of the refuelling equipment fuel pump.

Note. The lower end of the filling tube of tanks Nos 1, 2, and 3 is connected via a pipe to the refuelling equipment pipe union.

6. Filling fuel tanks Nos 4, 5, and 6 from the refuelling equipment is carried out in the following sequence:

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(a) connect one end of a swing hose to the dispensing pipe union located on the housing of the refuelling equipment and immerse the other end into the filler neck of the tank group to be filled (group II), (Fig.21);

(b) open the left valve located on the housing of the refuelling equipment (Fig.22);

(c) turn on the toggle switch of the refuelling equipment fuel pump.

7. Filling tanks Nos 7 and 8 (Fig.21) is carried out in the following sequence:

(a) open the right valve of the refuelling equipment;

(b) open the special shut-off valve on the bottom plate of tank 7 located under the fuselage between frames 18 and 19. When the shut-off valve is being opened the red pilot lamp of the light panel CLOSE VALVE on the flight engineer's panel comes on;

(c) turn on the toggle switch of the refuelling equipment pump.

8. Filling of tanks Nos 7 and 8 over, close the shut-off valve. As a result, the red pilot lamp of the light panel CLOSE VALVE should go out.

CAUTION. Failure to observe the instructions under Para.8 may cause overfilling of tanks Nos 7 and 8 during operation of booster pumps in other tanks and expulsion of fuel through the vent pipe outboard.

9. Filling of upper tanks Nos 9, 10, and 11 (Fig.21) is carried out in the following sequence:

(a) open the right valve of the refuelling equipment;

(b) open the electromagnetic shut-off valve of group IV (tanks Nos 9 and 10).

To do this, turn on the toggle switch FUELLING VALVE OF GROUP IV (КРАЙ ЗАПРАВКИ IV ГРУППЫ).

This should result in flashing of the red pilot lamp of the electric panel CLOSE VALVE on the flight engineer's panel. In this fuelling variant the fuel is simultaneously fed to tanks 10 and 11, tank 9 being filled from tank 10; (17)

(c) turn on the toggle switch of the refuelling equipment.

10. The filling of tanks 9, 10, and 11 over, close shut-off valve 1 FUELLING VALVE OF GROUP IV by turning off the toggle switch. As a result, the red pilot lamp should go out. (17)

Notes: 1. If the shut-off valve is not closed, the sequence of fuel consumption from tanks in flight will be disturbed.
2. When tanks are filled from the inboard refuelling equipment, group V (tank 11) remains underfilled by 90-95 litres.
3. If necessary, top up the tanks of groups IV and V (tanks 9, 10, 11) by the ground fuelling means through the filler necks of tanks 10 and 11.

C. Filling Fuel Tanks by Inboard Refuelling

Equipment from Tank Installed in Cargo Compartment

1. When it appears necessary to fill helicopter tanks from a tank carried in the cargo compartment act as follows:

(a) connect one end of the swing-type fuelling hose to the pipe union located on the starboard (inside the fuselage between frames 2 and 3) which is connected to the refuelling equipment pump and insert the other end of the hose into the tank filler neck;

(b) open the following valves:

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- (1) right valve (tanks 9, 10, and 11) on the refuelling equipment to fill the upper tanks (9, 10, and 11) and tanks 7 and 8;
 - (2) central valve for fuelling tanks 1, 2, 3;
 - (3) left fuelling valve to fill tanks 4, 5, and 6; before opening the left valve connect the hose to the dispensing pipe union;
 - (c) open the shut-off valve on the fuelling hose;
 - (d) turn on the refuelling equipment pump toggle switch.
2. Filling of the fuel system from the tanks carried in the cargo compartment may be performed as follows:
- (a) on the ground - all groups (see the fuelling sequence in Paras 5-10);
 - (b) in flight - only tank 11 (group V).

CAUTION. In case filling of tank 11 in flight is anticipated be sure to open the fuelling valves of tanks 7 and 8 (group III and upper tanks 9, 10, and 11 before the take-off. The valves are mounted in the housing of the three-way valve of the refuelling equipment (Fig.22).

D. Filling Tank Carried in Cargo Compartment

1. Filling the tank carried in the cargo compartment of the helicopter is performed in the following sequence:
 - (1) Using a swing hose, connect the inboard refuelling equipment to the tank to be filled. To effect this, connect one end of the hose to the dispensing pipe union of the refuelling equipment and insert the other end into the tank to be filled.
 - (2) Open the left valve of the refuelling equipment (distribution of fuel to tanks).
 - (3) Switch on the motors of the refuelling equipment pumps.
2. The fuelling operations over, act as follows:
 - (a) close the valve of the inboard refuelling equipment;
 - (b) disconnect the hose;
 - (c) plug and lock the intake pipe union of the refuelling equipment.

E. Helicopter Fuelling with External Tanks Attached

1. Filling by a refuelling truck:
 - (a) tanks 1, 2, 3, 4, 5, 6, 9, 10, and 11 (groups I, II, IV, and V) are filled as described in Paras 1, 2, and 3, Section A.
 - (b) tanks 7 and 8 (group III) are filled as follows:
 - through the filler neck of tanks 7 and 8 (in this case it is necessary to fit a 400-mm long durite hose on the dispensing gun of the refuelling truck since otherwise the access panel of the filler neck cannot be fully opened with the external tanks attached;
 - through the filler neck of the right external tank.

Note. Filling tanks 7 and 8 (group III) from the inboard refuelling equipment is carried out in the sequence described in Para.7, Section "Helicopter Servicing by Inboard Refuelling Equipment".

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CONFIDENTIALF. Filling External Tanks

The external tanks are filled through their respective filler necks. It is well to remember that filling of the external tanks will result in simultaneous filling of tanks Nos 7 and 8 if the latter are empty.

G. Filling Helicopter Fuel Tanks to 30%Total Capacity

For convenience in operation, fuelling the helicopter tanks to 30% total capacity should be carried out in the following sequence:

(a) All Tank Groups Empty

1. Switch on the ground power supply and the fuel consumption control circuit breakers on the flight engineer's panel.
2. Fill tanks Nos 1, 2, and 3 with kerosene from the refuelling truck through the filler neck of fuel tanks group I. Check to see that the fuelling is over by flashing up of the white pilot lamp located on the flight engineer's *control* board.
3. Set the fuel consumption control switch located on the flight engineer's control panel in MANUAL position and the fuelling valve of tanks group IV in CLOSED position. Make sure that the yellow pilot lamp indicating the position of the fuelling valve of group IV is not burning; engage the booster pumps of group I (tanks Nos 2 and 3) and check functioning of the pumps by flashing up of the green pilot lamp indicating functioning of the pumps of the lower fuel tanks.
4. Check the fuel transfer from tanks Nos 2 and 3 to group V (tank No.11) by the fuel level gauge. After the fuel is completely transferred switch off the booster pumps of tanks group I (tanks 2 and 3).
5. Refill tank No.11 with fuel through the filler neck of tank group V. Check the level gauge to make sure that tanks Nos 1 and 11 are fully filled and tanks 2 and 3 are empty. Disconnect the ground power supply source.

(b) Less than 40% of Fuel Left in Group II
and Non-Consumed Fuel in Groups I
and V

(variant when all fuel is consumed from tank groups IV and II
and more than 60% of fuel is consumed from tank group II)

1. Drain off the fuel from tank No.11 completely through the drain valve located on the starboard of the fuselage near frame No.20.
2. Switch on the ground power supply source and the fuel consumption control circuit breakers on the flight engineer's panel.
3. Set the fuel consumption control switch on the flight engineer's control panel in MANUAL position and the fuelling valve of tank group IV in CLOSED position (the yellow pilot lamp should be dead), engage the booster pumps of group II (tanks Nos 4 and 6) and transfer the remaining fuel from group II to group V. Check by the fuel level gauge that the tanks of group II are empty and disengage the booster pumps of group II (pumps of tanks Nos 4 and 6).

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4. Engage the booster pumps of group I (tanks Nos 2 and 3) and transfer the fuel from tanks Nos 2 and 3 to group V, checking the fuelling operation by the fuel level gauge. Check the fuel level gauge to make certain that tanks Nos 2 and 3 are empty and disengage the booster pumps of group I (tanks Nos 2 and 3). Check the fuel level in tank group V.

5. If necessary, refill tank group V from the refuelling truck through the filler neck of tank 11.

(c) Tanks Filled in Excess of Quantity
Indicated in Para "b"

1. Drain off fuel from all groups of tanks through the drain valves located in the cargo compartment near frame No.14 (lower tank groups) and on the starboard of the fuselage near frame No.20 (upper tank groups). To reduce the defuelling time it is allowed to engage the booster pumps of the tank groups with the ground power supply switched on.

2. After draining of all fuel it is necessary to fuel the helicopter to 30% total capacity as instructed in Para."a" of the present subsection.

III. DRAINING FUEL FROM HELICOPTER TANKS

1. Draining fuel from the tanks of the fuel system is carried out through the following drain valves:

(a) from lower fuel tanks Nos 1, 2, 3, 4, 5, and 6 by gravity through the drain valve located in the cargo compartment on the bottom section of the fuselage (near frame No.14). Open the drain valve. The shut-off valve of tanks Nos 7 and 8 should be kept closed;

(b) from lower tanks Nos 7 and 8 by gravity through the same drain valve with the shut-off valve of tanks Nos 7 and 8 open (Figs 20, 21);

(c) from upper tanks Nos 9, 10, and 11 by gravity through the drain valve located on the starboard of the fuselage near frame No.20 (Figs 20, 21). Open the drain valve.

2. When the fuel is drained from upper tanks Nos 9, 10, and 11 it is possible to defuel groups IV and V separately (tanks Nos 9, 10, and 11). To do it, proceed as follows:

(a) when draining fuel from tanks Nos 9, 10 (group IV):

- close the cross-feed valve (on frame 19 of the cargo compartment ceiling);
- open the drain valve;
- keep the shut-off valve of tanks Nos 9 and 10 open.

(b) when draining fuel from tank No.11 (group V):

- close the shut-off valve of tanks Nos 9 and 10 (group IV);
- close the cross-feed valve;
- open the drain valve.

3. The fuel from the external tanks is drained off also through the drain valve of lower tanks Nos 7 and 8;

- open the shut-off valve of tanks Nos 7 and 8.

4. To reduce the defuelling time it is allowed to engage the HNB-2 booster pumps.

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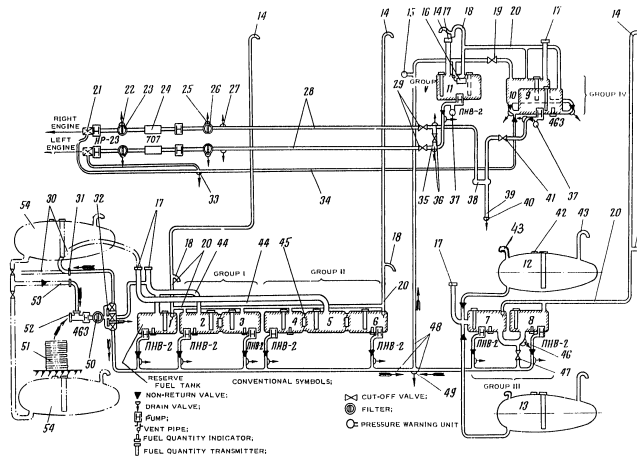


FIG. 21. FUEL SYSTEM SCHEMATIC DIAGRAM
 1 - reserve fuel tank; 2, 3, 4, 5, 6, 7, 8 - lower fuel tanks; 9, 10, 11 - upper fuel tanks; 12, 13 - external fuel tanks; 14 - hot air trunk for heating vent system pipes; 15 - UJ-25A pressure warning unit; 16 - float valve; 17 - filter neck; 18 - outlet end of vent piping (to atmosphere); 19 - solenoid-operated control valve of tubed reflecting equipment; 20 - vent piping; 21 - engine stop cock; 22 - valve for draining sediment from line filter; 23 - line filter; 24 - PTMC 1.8 G-1 flow meter; 25 - valve for draining sediment from coarse filter; 26 - coarse filter; 27 - valve for draining sediment from piping; 28 - fuel supply piping; 29 - fuel shut-off valves; 30 - swing-type hose for fuelling 2nd tank group from tanks carried in cargo compartment; 31 - pipe union for ground fuel supply to tanks; 32 - special three-way valve; 33 - valve for draining fuel from piping; 34 - pipe for draining fuel from engine stop cocks into tank; 35 - fuel control valve; 36 - air-bleed valves; 37 - UJ-16A fuel pressure warning unit; 38 - fuel manifold; 39 - piping for draining fuel from upper tanks; 40 - valve for draining fuel from upper tanks; 41 - selector valve for autonomous defuelling of 4th and 5th tank groups; 42 - filter neck of external tank; 43 - vent piping of external tank; 44 - fuelling line; 45 - vent interconnection piping of 1st and 2nd tank groups; 46 - valve for draining sediment from interconnection piping and defuelling 3d tank group; 47 - control valve for fuelling 3d tank group; 48 - fuel transfer piping; 49 - valve for draining fuel from lower tanks; 50 - coarse filter; 51 - ground tank; 52 - pipe union for pumping fuel from ground tanks; 53 - pipe union and hose for fuel transfer on ground and in flight from tanks carried in helicopter cargo compartment; 54 - tanks carried in helicopter cargo compartment.

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Draining Fuel Sediment
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The fuel sediment is drained off as follows:

- (a) from lower tanks (Nos 1, 2, 3, 4, 5, 6, 7, and 8):
 - through the tanks drain pipe common valve located under the access panel on the bottom side of the fuselage;
 - separately from each tank, through the drain valves (8 pcs) installed in the fuel line of the tanks (Figs 20 and 21).
 - (b) from upper tanks (Nos 9, 10, and 11):
 - through the drain valves (4 pcs) of these tanks.
- The valves are installed under the tanks on the cargo compartment ceiling (Figs 20 and 21).

IV. FILLING HELICOPTER WITH OIL

P r e l i m i n a r y p r e p a r a t i o n

1. Check the quality of the delivered oil by the Certificate and make sure that the latter contains permission for use of the particular oil in the helicopter.
2. Check presence of seal caps on the oil tank truck and condition of strainers in the dispensing guns.

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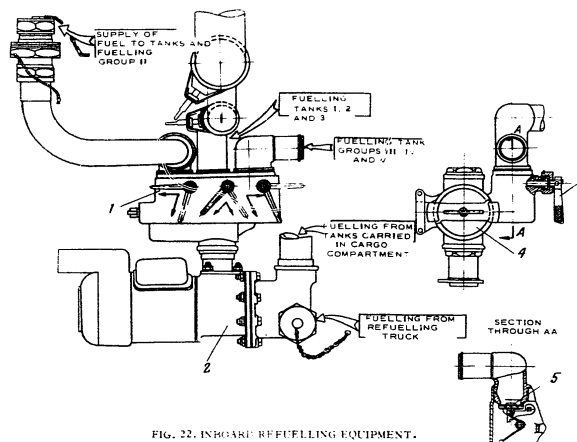
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FIG. 22. INBOARD REFUELLING EQUIPMENT.

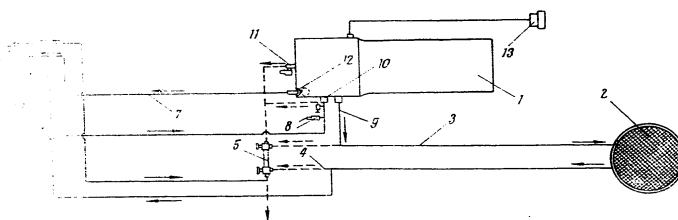


FIG. 23. ENGINE LUBRICATING SYSTEM SCHEMATIC DIAGRAM

1 - oil cooler; 2 - oil pipes; 3 - drain pipes; 4 - assembly of drain valves; 5 - oil tank; 6 - breather pipes;
7 - oil temperature gauge; 8 - pipe for feeding oil to oil cooler; 9 - engine oil pump; 10 - engine drain valve;
11 - engine breather; 12 - oil pressure gauge transmitter.

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3. Drain off sediment from the bowl of the oil tank truck. Make certain that the oil is clean. Drain off 1-2 litres of oil through the dispensing gun into a clean vessel. Make sure that the drained oil is clean and contains no mechanical impurities, alkali or water. If not so, do not fill the helicopter oil system with oil and report the trouble to the engineer.

4. Ground the helicopter and the oil tank truck.

(1) Filling Engine Oil Systems

1. The helicopter engines should be mainly operated on grade MK-8 oil (FOCT 6457-53).

2. Besides, it is allowed to use transformer oil (FOCT 982-53). The transformer oil with a pour point from -45 to -54°C is allowed for use at ambient air temperatures not lower than -30°C.

3. At ambient air temperatures below -30°C fill the engines with MK-8 oil.

4. The transformer oil with a pour point of -55°C and lower may be used as an equivalent to MK-8 oil.

5. Mixing of MK-8 oil with the transformer oil in the oil system is allowed provided the temperature limitations indicated above are taken into consideration.

6. Filling of oil tanks is carried out by means of a dispensing gun through the tank filler necks (Figs 20 and 23). To this end, open the access panels located on the skin of the engine intake ducts. The dispensing hose fitted with a gun for oil filling is lifted by means of the sling stowed in the bay located in the front section of engine cowls.

7. The normal capacity of each tank is 23 litres without oil left in the engine oil system.

The quantity of oil filled in the tanks is checked by oil dipsticks.

(2) Filling Oil System of P-7 Main Gear Box

1. The oil system of the main gear box is filled with the following oils:

(a) in summer - mixture of 75% (by volume) of MC-20 or MK-22 oil (FOCT IOI3-49) and 25% of MK-8 oil (FOCT 6457-53) or transformer oil (FOCT 982-56);

(b) in winter - mixture of 50% (by volume) of MC-20 or MK-22 oil and 50% of MK-8 oil (FOCT 6457-53) or transformer oil.

Note. Transformer oil should be used only as a substitute for MK-8 oil at ambient air temperature not lower than -30°C.

2. Mixing of transformer oil with MK-8 oil during replenishment of the gear box is allowed. The above mixture should be used at ambient air temperatures not lower than -30°C.

3. The total quantity of oil to be filled in the main gear box oil system (regardless of 65 lit of oil contained in the external oil system) should be minimum 150 litres and maximum 170 litres.

Note. The quantity of oil always remaining in the main gear box (including the oil pan) after draining procedure should be 20-25 litres.

4. Filling of the main gear box with oil is carried through two filler necks (Figs 20 and 24) in the following order:

(a) fill 170 litres of oil in the gear box;

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- (b) start the engine and let it run for 2-3 min ;
- (c) stop the engines and add oil (about 60 litres) so that the oil level is between the upper and lower marks of the oil dipstick.

Notes: 1. The difference between the levels of cold and hot oil may reach 10-15 litres.

2. The oil level should be measured by means of two oil dipsticks.

5. The oil quantity contained in the main gear box should be checked by cold oil prior to engine starting. It is determined as arithmetical mean of readings of both oil dipsticks (which are installed on the left and right sides of the gear box) (Fig.24). The average oil level should be located between the upper and the lower mark lines of the oil dipsticks.

CAUTION. Before filling oil into the main gear box make sure that the vents of the oil coolers are blanked off.

6. Prior to filling oil into the main gear box oil system the mixture should be thoroughly stirred at a temperature of 18-20°C.

(3) Filling Oil into Intermediate Gear Box

1. The following oils should be used in the intermediate gear box:
 - (a) in summer - hypoid gear oil (FOCT 4003-53);
 - (b) in winter - mixture of 2/3 of hypoid gear oil (FOCT 4003-53 and 1/3 of AMT-IO oil (FOCT 6794-53) by volume.
2. The intermediate gear box is filled through the hatch and filler hole in the gear box case. To do this, screw off the plug of the filler hole and pour the oil through a funnel fitted with screen No.24.
3. The intermediate gear box is filled with 7 litres of oil.
4. The oil filled into the intermediate gear box is checked by an oil dipstick. The oil level should reach the upper mark of the oil dipstick.
5. Addition of oil to the gear box in the course of service may be done through the hole for the oil dipstick.

(4) Filling Oil into Tail Gear Box

1. The following oils should be used in the tail gear box:
 - (a) in summer - hypoid gear oil (FOCT 4003-59);
 - (b) in winter - mixture of 2/3 of hypoid gear oil and 1/3 of AMT-IO oil (FOCT 6794-53) by volume.
2. The tail gear box is filled through the breather hole or the oil dipstick hole. Prior to filling oil the breather (oil dipstick) should be removed. The oil is poured through a funnel fitted with screen No.24.
3. The tail gear box should be filled with 26 litres of oil.
4. The oil level is checked by the oil dipstick. The oil level should reach the upper mark (mark "B") of the oil dipstick.
5. During service the oil may be added into the tail gear box through the oil dipstick hole.

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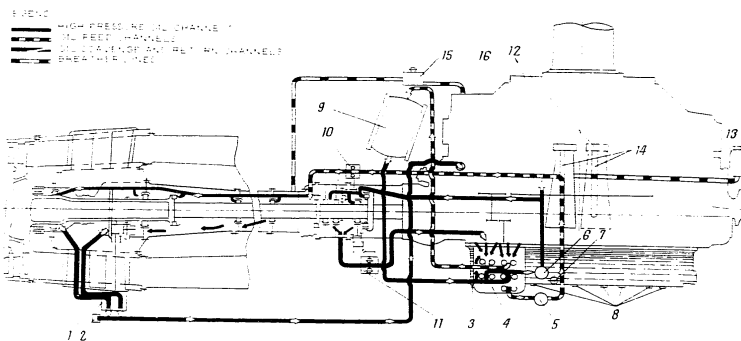


FIG. 24. LUBRICATING SYSTEM OF MAIN GEAR BOX AND FREE TURBINES SCHEMATIC DIAGRAM
 1 - MHP-251 scavenge oil pump; 2 - drain plug; 3 - plug for additional oil draining from P-7 gear box; 4 - MHP-23 main oil pump; 5 - MHP-13-13 oil filter; 6 - MHP-13-14 oil filter; 7 - valve for draining oil from gear box; 8 - magnetic plugs (9 pcs); 9 - cooler; 10 - transmission oil pump; 11 - pumps for scavenging oil from housings and gear box power equalizing mechanisms (2 pcs); 12 - filler necks; 13 - gear box breather tank; 14 - oil dipsticks; 15 - breather tank of free turbine transmission; 16 - 30-20 chip-detecting filter.

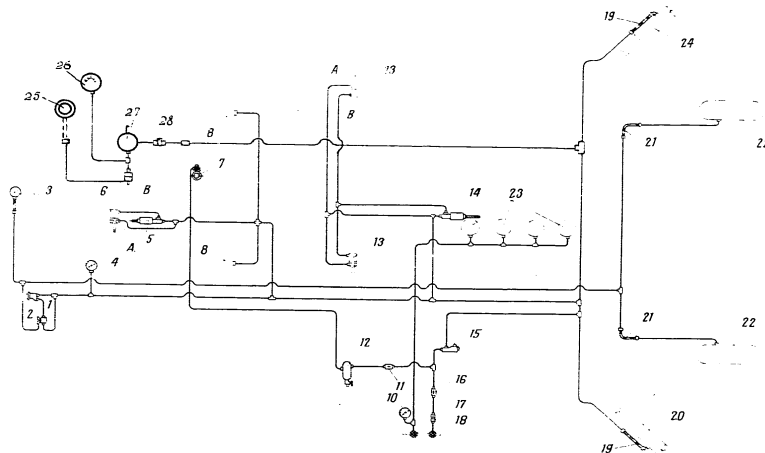


FIG. 25. AIR SYSTEM SCHEMATIC DIAGRAM
 1 - 51101-11 deboost valve; 2 - 113-7 reducing valve; 3 - MB-60M pressure gauge; 4 - MB-100M pressure gauge; 5 and 14 - solenoid-operated air valves; 6 and 13 - actuating cylinders for control of butterfly valves installed in T-pipes of cabin heating and ventilation system; 7 - AK-50T compressor; 8 - solenoid-operated automatic air valves; 9 - pipe union for charging hydraulic accumulators; 10 - MB-250 pressure gauge; 11 - non-return valve; 12 - filter with bowl; 13 - A-1-50 automatic pressure controller; 14 - non-return valve; 15 - air strainer; 16 - pipe union for charging air bottles; 17 and 21 - flexible hoses; 20 and 24 - air bottles; 22 - main L.G. wheels; 23 - hydraulic accumulators; 25, 26, 27, 28 see fig. 39 (helicopter armament).

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V. DRAINING OIL FROM HELICOPTER OIL SYSTEM

(5) Draining Oil from Engine Oil System

Draining oil from the engines is performed as follows:

- (a) from the oil piping and coolers - through the drain valves located in one body under the front section of the engine compressor (Figs 20, 23);
- (b) from the oil tanks - through the valves located in the front section of the engine housings;
- (c) from the engine oil sumps - through the valves located in the front section of the engine housings.

(6) Draining Oil from Main Gear Box and Free Turbines

Draining oil from the main gear box into a ground tank (250 lit capacity) is carried out by means of a 4.5m long hose in the following way:

- (a) through the oil sump drain valve located in the left lower part of the gear box case;
- (b) from the external oil system - through the drain valve of the oil sump; in this case it is necessary to remove preliminarily the plugs from the vent piping of the gear box oil coolers;
- (c) through the drain valves of the oil pipes running from the free turbines to the cooler.

Note. To ensure complete draining of oil screw off the plug for additional oil draining located in the front section of the oil sump bottom and remove the plugs from the vent piping of the gear box oil coolers.

(7) Draining Oil from Intermediate Gear Box and Tail Gear Box

1. The oil is drained from the intermediate gear box through a special drain valve which is accessible through the hatch normally used for inspection of the intermediate gear box (Fig.115).
2. The oil is drained from the tail gear box through the drain valve and from the pockets of the gear box case through two drain plugs.

VI. FILLING HELICOPTER HYDRAULIC SYSTEMS

1. The hydraulic systems of the helicopter should be filled with grade AMP-IO oil (FOCT 6794-53).
2. The normal capacity of the helicopter hydraulic systems is 110-120 litres.
3. To fill the hydraulic systems of the helicopter, proceed as follows:
 - (a) open the access panels of the filler necks of the hydraulic reservoirs, remove the filler caps and pour AMP-IO oil through a funnel furnished with cambric cloth filter until the oil gauge glass indicates 40-45 litres in either chamber of the reservoir (duplicating and main systems);
 - (b) install the filler caps of the hydraulic reservoirs in place and close the access panels;
 - (c) check functioning of the hydraulic systems from the hydraulic trolley;
 - (d) the testing of the hydraulic system over, measure the oil level once more by the readings of the oil level indicator.

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4. In case the hydraulic system is empty the oil filling may be performed by means of a ground hydraulic trolley in the following sequence:
- (a) connect the pressure hose of the ground hydraulic trolley through the fine filter to the inlet pipe union of the helicopter main hydraulic system;
 - (b) put the suction hose of the ground hydraulic trolley into the tank with AMT-10 oil;
 - (c) switch on the hydraulic trolley and check the oil levels in both chambers of the hydraulic reservoir. Switch off the pump of the hydraulic trolley if the pointers indicate 40-45 litres of oil in each chamber;
 - (d) Check the oil level in the hydraulic reservoirs *by level indicating glasses.*

VII. CHARGING HELICOPTER AIR SYSTEM

1. The helicopter air system should be charged only from the airfield cylinders specially designed for the purpose.
The valve of the airfield cylinder should be serviceable and reliably closed with a protective bonnet.
2. All the air bottles located in the left and right shock struts are charged with compressed air simultaneously through the charging air pipe union located on the port side of the fuselage (Fig.25).
3. To perform air charging, proceed as follows:
 - (a) arrange the airfield cylinder at the port side of the fuselage;
 - (b) remove the protective bonnet of the cylinder valve. Tilt the cylinder by 10-15° with the valve down and open the latter for a short period to remove moisture from the cylinder;
 - (c) connect the charging hose to the airfield cylinder;
 - (d) open the valve of the airfield cylinder and purge the charging hose;
 - (e) remove the plug from the helicopter charging pipe union (located on the port side) and connect the charging hose to it;
 - (f) open the tap on the bowl of the air system strainer and drain off the sediment;
 - (g) place the airfield air cylinder with the valve up and open the cylinder valve.
4. The helicopter air system should be charged with compressed air until the pressure in the system reaches 50 kg/sq cm. The charging pressure should be checked by the helicopter pressure gauge located on the flight engineer's *control* board.
5. As soon as the pressure gauge reads 50 kg/sq cm close the valve of the airfield air cylinder, disconnect the charging hose and install the plug on the helicopter charging pipe union.

VIII. CHARGING HELICOPTER OXYGEN SYSTEM

1. The helicopter oxygen bottles should be charged only with medical oxygen. When charging the system strictly observe safety precautions generally adopted for oxygen handling.
2. The oxygen bottles intended for supply of oxygen to the crew are charged through the helicopter charging pipe union fitted with a non-returned valve.

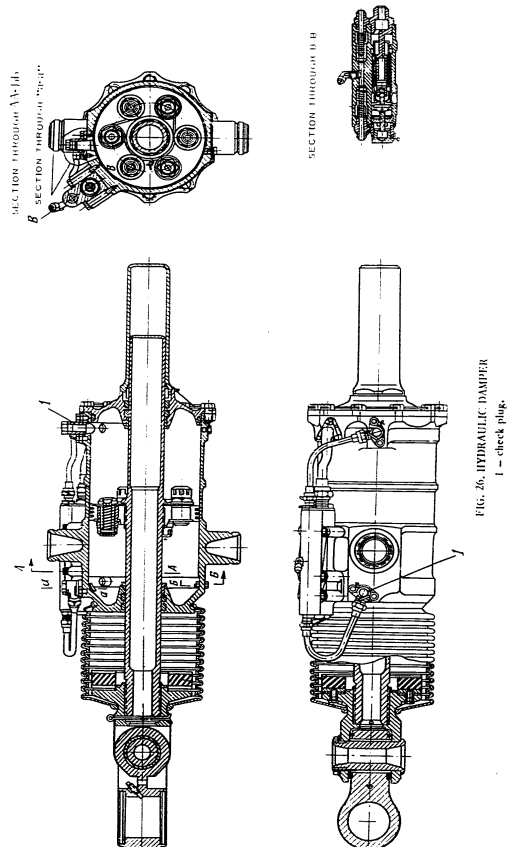
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3. The helicopter oxygen bottles are charged until the pressure in the system reaches 150 kg/sq. cm.

IX. FILLING OIL INTO HYDRAULIC DAMPERS OF MAIN
ROTOR HUB AND COMPENSATING SYSTEM

1. The rotor hub hydraulic dampers should be filled with oil separately.
2. The filling procedure is as follows:
 - (a) turn the main rotor so that the damper to be filled is placed square to the longitudinal axis of the helicopter;
 - (b) remove check plugs 1 in both chambers of dampers and screw off the filler cap of the compensating tank (the check holes of the damper are accessible in the same way as the thin tubes of the valve box) (Fig.26);
 - (c) pour AMT-10 hydraulic oil into the compensating tank through the filler hole (the tank capacity is 2.5 litres). The compensating tank should be filled until hydraulic oil runs through the check holes in a clean, bubble-free stream.

Note. To reduce the charging time the hydraulic oil may be supplied not through the compensating tank but directly through the valve box pipe unions by means of a hand-operated pump;

- (d) install and lock the plugs of the check holes.
3. After filling of all the five dampers replenish the compensating tank until the oil level reaches the upper edge of the gauge glass.
4. Screw in the plugs of the filler holes and lock them.

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Chapter IV
SCHEDULED MAINTENANCE OPERATIONS
GENERAL

1. All the scheduled maintenance operations should be carried out in compliance with the present Chapter and requirements contained in the Operating and Maintenance Instructions on individual accessories as well as with the acting service bulletins.

2. Before conducting any kind of maintenance operations the materiel should be inspected within the scope of the post-flight inspection. All the detected troubles should be corrected.

3. All the maintenance operations on the helicopter should be performed by means of factory-made serviceable tools and appliances.

Before the beginning and at the end of maintenance operations carried out on the helicopter check the tools by the respective inventory so as to make sure that no tools are left in the helicopter.

4. The scheduled maintenance operations on the helicopter frame, engine, radio and other equipment should be performed at fixed intervals determined by the total flying time of the helicopter (including 100 per cent of helicopter operation in flight, plus 20 per cent of operation on the ground).

5. After replacement of a helicopter engine or any accessory the scheduled maintenance operations on these are carried out at intervals determined by the flying hours or by certain time periods (when the helicopter is in storage). In this case it is allowed to perform the nearest maintenance operations on the newly installed engine or accessory ahead of schedule.

6. The ensure trouble-free operation of the materiel in diverse climatic conditions (dusty air, high humidity, etc.), or when specific missions impose heavier loads on particular accessories (flights in unfavourable weather conditions, with maximum all-up weight, frequent landings, etc.) as well as in cases of long stand-by periods or replacement of engines and main accessories of the helicopter, the organization engineer is authorized to issue orders on performance of non-scheduled maintenance operations on all or separate helicopters (accessories) in compliance with the present Chapter.

7. Before performing inspections and maintenance operations clean the exterior of the helicopter frame, engines, equipment, their wiring and piping from dirt, dust, ice, hoar-frost, snow, and old grease.

8. The high-pressure air bottles should be tested for strength and leakage in a routine manner at intervals indicated on the bottles and in the bottle Certificates.

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9. Never wash closed-type ball bearings with gasoline (kerosene); the ball bearings should be only wiped dry and coated with a thin layer of grease.

10. Whenever performing maintenance operations pay special attention to detection and correction of the following troubles:

- cracks, dents and mechanical damage to parts;
- absence of locking devices and loose nuts;
- leaky piping and accessories of fuel, oil, hydraulic and other systems;
- damaged coatings and corroded parts;
- excessive play in hinged connections and poor lubrication;
- rubbing of movable parts against structural elements of the helicopter;
- loose riveted joints;
- loose seating and unreliable attachment of covers, access panels, cowls and fairings.

I. OPERATIONS TO BE DONE AFTER FIRST TEST-RUNNING OF ENGINES AND P-7 GEAR BOX

1. Perform maintenance operations within the scope of the post-flight inspection.
 2. Right after stopping of the main rotor check the temperature of the brake drum by hand-feel. (In this case the main rotor is stopped without application of the brake).
 3. Drain off the oil from the engine through the drain valve located on the lower accessories drive gearbox. Inspect and wash the filters, after which fill the system with new oil. The engine should not be allowed for further use unless the filters are clean.
 4. Then the first test-running of the P-7 gear box is over, drain off the oil, remove and inspect the oil filters and the magnetic plugs of the main gear box. After inspection wash the filters and the magnetic plugs with clean kerosene and install in place.
 5. Remove the coarse and fine filters of the fuel system, check their condition, wash with kerosene and install in place.
 6. Tighten up and lock the attachment bolts of the exhaust pipe.
- Note. 16 bolts of each exhaust pipe located between the engines should be locked right after installation of the exhaust pipe. Do not tighten up the bolts after the first test-running of the engine.

II. OPERATIONS TO FOLLOW FIRST FLIGHT WITH NEWLY INSTALLED ENGINES AND MAIN GEAR BOX

1. Inspect the helicopter and engines within the scope of post-flight inspection.
2. Drain off the oil from the engine through the drain valve located in the lower accessories drive gearbox.
3. Inspect the oil filters of engines, main gear box and the HC-23 chip-detecting filters, wash and reinstall the filters. Fill new oil into the engine.
4. Inspect the HP-23 pump fine fuel filters, wash and reinstall them.
5. Handfeel all the splined joints of the tail shaft. In case of excessive heating of any splined joint as compared to other joints it is necessary to check

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alignment of the support of the particular joint with respect to the adjacent supports by means of the B9715-010 appliance.

Notes: 1. The check should be performed immediately after stopping of the main rotor.
2. The heating is considered excessive when the hand cannot endure the contact with the surface being checked long.

6. Check the temperature of the swashplate ring by hand-feel: no considerable heating should be felt. The check should be carried out immediately after stopping of the main rotor.

7. Remove the check plugs of the hydraulic dampers of the main rotor hub and release the accumulated air. Check the level of AMP-IO oil in the compensating tank of the hydraulic dampers. The level of AMP-IO oil in the tank should reach the upper edge of the gauge glass.

8. After stopping of the main rotor drain off 2-3 litres of oil from the main gear box oil sump through a funnel fitted with screen No.24 and check the screen for cleanliness.

9. Inspect the attachment fittings of the main gear box. Make sure that the fittings are properly locked.

III. OPERATIONS TO FOLLOW FIRST FIVE HOURS OF HELICOPTER FLYING

1. Perform maintenance operations on the helicopter frame and the engines within the scope of the post-flight inspection.

2. Drain off the oil from the engine through the drain valve located in the lower accessories drive gearbox and fill new oil.

3. Inspect the oil filters of the engines, wash them and reinstall.

4. Inspect the fittings attaching the wing to the fuselage.

5. Inspect the fittings attaching the control units to the wing.

6. Check tightening of the nut attaching the main rotor hub on the shaft of the main gear box and pay special attention to correct assembly of the slip ring.

7. Check tightening of the attachment bolts of the main rotor blade turning arm.

8. Check tightening of the hydraulic damper cap attachment bolts.

9. Replace grease in the hinges of the main rotor hub.

10. Check presence of grease in the flapping and drag hinges of the main rotor hub. If necessary, add grease as required.

11. Remove the check plugs of the hydraulic dampers and release the accumulated air. When oil starts flowing from the check holes in a clean bubble-free stream, install the plugs and add new oil in the compensating tank. Make sure that there is no leakage through the gaskets of the check plugs.

If necessary, replace the plug gaskets.

12. Check the attachment bolts of two flanges of the swashplate ring bearing for proper tightening.

13. Check tightening of the blade turning arm attachment bolts and counterweights on the tail rotor.

14. Check the temperature of the swashplate ring bearing by hand-feel. The temperature of the bearing should not exceed the normal limits (the check should be carried out immediately after stopping of the main rotor).

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15. Check tightening of the nut of the front cone attaching the tail rotor on the tail gear box shaft and the nut of the spider front end.

IV. EVERY 50-5 FLYING HOURS

Perform all the operations within the scope of the post-flight inspection. Besides, perform the following maintenance operations:

(1) AirframeA. Main and Tail Rotors

1. Release air (air locks) from the hydraulic dampers and replenish hydraulic oil into the compensating tank (see Section "Operations to be Performed After First Flight with Newly Installed Engines" Para. 6 and Main Gear Box, Para. 7).
2. Replace grease in the feathering hinges of the main rotor hub.
3. Check tightening of the following bolts:
 - (a) the attachment bolts of the main rotor blade turning arms;
 - (b) the attachment bolts of the hydraulic damper caps;
 - (c) the attachment bolts of blade turn levers and counterweights of the tail rotor.

B. Helicopter Control System

1. Check and, if necessary, adjust tension of the control wire ropes of the tail rotor and stabilizer depending on the ambient air temperature in compliance with the respective Graphs.
 2. Inspect the helicopter control linkage. In case fretting is detected on the link-rods where they contact the guide rollers, determine the degree of fretting. This is determined by the size of the clearance between each roller and the control link-rod. The clearance should not exceed 0.7 mm. The clearance is measured between any of the three rollers and the control link-rod when the latter is in touch with two other rollers. ②
 3. Check the bolts attaching the flanges of the outer and inner races of the swashplate ring bearings for proper tightening.
 4. Wash and lubricate the hinged joints of the flight controls.
- CAUTION. Never wash the closed-type bearings; replace only the corrosion-preventive grease.

C. Engine Oil System

1. Unlock the filter covers, screw off the filtering elements from the filter units and thoroughly inspect them.
Wash the filtering elements with clean unleaded gasoline, install them in place and lock the covers.
2. Unlock and screw off the plugs from the bowls of the filter units. Wash the bowls with clean unleaded gasoline, install and lock the plugs.

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— 71 — **CONFIDENTIAL**D. Transmission and Fan Unit

1. See that the bolts joining the flanges of the tail shaft are not loose and make sure that the bolts attaching the tail shaft supports to the frames are properly tightened.
2. Check the oil filters of the intermediate and tail gear boxes and the magnetic plug of the intermediate gear box.
3. Check attachment of the intermediate and tail gear boxes, make sure that the nuts are properly tightened and there are no cracks on the flanges. See that the locks are in good condition.
4. Check attachment of the fan.
5. Check tightening of the fan impeller-to-shaft flange attachment bolts.

E. Fuselage, Tail Boom and Pylon

1. Inspect the wing spar-to-fuselage attachment fittings, check condition of the bolted flange joints of the wing spar, as well as the fittings attaching the FMK-1 wing control hydraulic mechanism to the wing spar and the fuselage. Lubricate the hinged joints of these fittings. Check condition of the FMK-1 mechanism and the associated hoses of the hydraulic system.
2. Inspect the loading doors and ramps of the cargo compartment. Check condition of the ramp hinged joints and renew grease in them.
3. Inspect the entry doors, loading doors, and the doors of the special equipment bay in the cargo compartment as well as the entry door of the navigator. Check condition of the door control linkage support fittings. Renew grease between the rubbing surfaces. Check condition of the sealing rubber tubes.
4. Inspect the mount of the P-7 main gear box, welded joints of the braces, forks and eye lugs for cracks, paying special attention to the butt ends of brackets and fittings attaching the mount to the fuselage. Check tightening of the bolts attaching the P-7 gear box to the mount. (u)
5. Inspect the seats of the pilots, navigator, flight engineer, and the radio operator. Check reliability of their attachment and functioning of the pilots' seats tilting mechanism.
6. Check tightening of the collapsible steps on frame No.9 in the pilots' cabin and make sure that they are reliably fixed in extreme positions. If the fibre washers are worn out, replace them with new ones.
7. Check condition of the external cargo sling system fittings. (u)

F. Landing Gear

1. Using a pressure gauge check pressure of nitrogen in the low- and high-pressure chambers of the main landing gear and in the shock-struts of the nose leg and the tail bumper.

The pressure should conform to the data indicated in Chapter III, Part II of the Instructions (Figs 42, 43). (u)

Note. The Graphs shown in Figs 42, 43 should be used only in case no leakage of hydraulic oil is noted in service.

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G. Fuel System

1. Remove, inspect and wash the coarse and fine filters of the fuel system.
2. Inspect the piping and accessories of the fuel system mounted under the cargo compartment floor, make sure that they are leakproof and see that the attachment clamps of durite connections are reliably tightened and locked. Make sure that the durite connections are reliably fixed in place.

(2) Engine and Main Gear BoxA. Engine

1. Inspect and wash the fine fuel filter of the HP-23A pump.
2. Remove, thoroughly wash the pipe and the air strainer supplying air to the starting control unit ("A3") as well as the jet for bleeding air from the starting control unit of the HP-23A pump and purge them with air pressurized to 1.5-2 kg/sq cm.
3. Using a strain gauge, check tension of the control wire ropes of the stop cocks "KO". The tension should be 20[±]3 kg. (3)

B. Gear Box

1. Drain off the oil from the gear box and the entire oil system through a funnel fitted with screen No.24 and inspect the screen.
2. Inspect and wash the magnetic plugs.
3. Inspect and wash the oil filters of the pressure and feed stages of the MHP-23 pumps oil system.
4. Inspect the transmission and accessories shrouds for proper attachment to the gear box. Check tightening and locking of attachment bolts and nuts of the units and accessories.
5. Tighten up all the connections of the oil piping and electric cables and make sure that they do not touch the parts and components of the helicopter frame and the gear box.

V. EVERY 100[±]5 FLYING HOURS

Inspect the helicopter within the scope of the post-flight inspection and carry out the maintenance operations specified for every 50[±]5 flying hours. Besides, perform the following operations:

(1) Airframe

1. Lubricate the joints as indicated in the Lubrication Table.
2. Remove the filtering element of the AK-50T air compressor, wash it with clean gasoline and blow with compressed air. Make sure that the inlet valve moves without binding.

A. Main Rotor Hub

3. Check tightening of the main rotor hub attachment nut.

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B. Hydraulic System (39)**CONFIDENTIAL**

4. Drain AMP-IO oil from the main, duplicating hydraulic systems, and from the hydraulic reservoirs.
5. Wash the hydraulic reservoirs and their filters with clean unleaded gasoline.
6. Pour 20 litres of AMP-IO oil into the reservoir of the main hydraulic system and 40 litres into the reservoir of the duplicating and auxiliary hydraulic systems.
7. Pump the oil through each system for 15 minutes and drain off the reservoirs and the system.
8. Prior to filling the hydraulic reservoirs with new AMP-IO oil, inspect and wash the filters of the hydraulic reservoirs with unleaded gasoline.
9. Fill the hydraulic reservoirs with new AMP-IO oil. Connect the VHT-250 air-field hydraulic trolley to the inboard pipe unions and check functioning of the hydraulic system.

CAUTION. Never mix new oil with used one.

C. Transmission

10. Replace oil in the intermediate and tail gear boxes.
11. Check the clearance between the brake shoes and the drum of the main rotor.
12. Check the shafts of the tail transmission for run-out (angularity of the splined joints). The run-out should be within 0.8 mm. Check the run-out by means of the B9715-010 appliance.

D. Landing Gear Wheels

13. Remove the wheels of the main and nose legs, thoroughly wash them, inspect the bearings and replace grease. Inspect the brake chambers, brake shoes and drums.

Note. Operations specified in this paragraph should be carried out every 100 flying hours but not less than every 200 landings.

E. Fuselage

14. Check functioning of the ball-type lock of the external cargo sling system hydraulic cylinder; to effect this, open the pipe unions of the hydraulic cylinder and apply a 10 kg load to the lever with a 500-mm arm. In this case the hydraulic cylinder rod should not go downward.

(2) Engine and Main Gear Box

15. Perform a random check of the exhaust pipe attachment bolts for tightening in 3-4 spots. In case a loose bolt is found, tighten up all the bolts. (2)
16. Perform the maintenance operations on the CTF-I2TM starter-generator as follows:
 - (a) remove the protective band;
 - (b) check reliability of contacts in all connections of the current-carrying wires and make sure that the springs of the brush holders are not cocked and the contact brushes are properly bedded;

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(c) check condition of the commutator and remove carbon from the commutator with a clean cloth soaked with clean unleaded gasoline. Remove the remaining carbon with BTC-ISO sand paper (FOOT 5009-52) by pressing the latter to the commutator and revolving the rotor of the starter-generator (if the commutator is burnt, replace the generator);

(d) check the length of contact brushes on the larger side of the brush. The brushes worn down to 18 mm should be replaced;

(e) the maintenance operations over, install the protective band in place. (56)

VI. EVERY 6 MONTHS $\pm$ 30 DAYS

1. Check functioning of the door jettisoning mechanisms; after inspection lubricate the rubbing surfaces, install the doors in place, mount the units of mechanisms and seal their knobs.

2. Carry out maintenance operations on the hydraulic system specified for every 100 $\pm$ 5 flying hours.

VII. EVERY 12 MONTHS $\pm$ 30 DAYS

1. Replace the explosive cartridges in the discharge bonnets of the fire extinguishers and see that the fire extinguisher bottles open easily.

2. Using a strain gauge, check tension of the stop cock "KO" control wire ropes. The tension should be 20 $\pm$ 3 kg.

VIII. HELICOPTER MAINTENANCE IN STORAGE

(A) Every 7 $\pm$ 3 Days

1. Perform cold cranking of the engine (if the latter is not processed) to extend the storage period of the helicopter.

2. See that the parts of the airframe and engines are not corroded.

3. Renew grease in the shock struts of the landing gear, tail bumper, and hydraulic boosters.

4. Inspect visually the blades of the main and tail rotors.

(B) Every 15 $\pm$ 5 Days

5. Carry out the operations indicated in subsection "A".

6. Carry out the operations within the scope of the pre-flight inspection.

7. Start and test-run the engines at 0.66 normal rating for 3-5 minutes. When the engines are running, check functioning of the main, duplicating and auxiliary hydraulic systems by engaging them in succession and checking operation of the actuating mechanisms. Check the hydraulic accumulators for proper charging.

8. Clean the helicopter from dust and dirt.

9. After summer rains and in high-humidity areas take advantage of good weather, remove all the jackets from the helicopter, open all the access panels and cowls (for airing). Dry the jackets.

10. Make sure that there is no leakage through the durite connections and flexible hoses of the oil, fuel, and hydraulic systems.

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CONFIDENTIAL(C) Every 30 $\pm$ 5 Days

11. Carry out the operations indicated in subsections "A" and "B".
 12. During preparation of the helicopter for flight carry out the maintenance operations within the scope of the post-flight inspection.

(D) Every 3 Months $\pm$ 10 Days

13. Carry out the maintenance operations indicated in subsections "A", "B" and "C".
 14. When preparing the helicopter for a flight mission perform a test flight for 30 minutes.

(E) Every 6 Months $\pm$ 15 Days

15. Carry out the maintenance operations indicated in Paras "A", "B", "C", and "D".
 16. Before the test flight carry out the maintenance operations specified for every 100 $\pm$ 5 flying hours.

IX. TABLE
 OF BOLTED JOINTS TO BE TIGHTENED WITH TORQUE WRENCHES

Description of unit	Nos	Location of joint	Dwg No.	Wrench size	Torque, kg-m	Torque wrench code	Tool code
1	2	3	4	5	6	7	8
Transmission and tail rotor assembly	1	Attachment of intermediate gear box to helicopter frame	B1501-000	S = 27	23-25	M9500-101	B9551-4
	2	Jointing of transmission tubes	B1501-000	S = 17	3-3.5	M9500-100	B9515-007
	3	Attachment of transmission shaft supports to tail boom frames	B1501-000	S = 17	2.5-3	M9500-101	B9515-8
	4	Attachment of transmission supports in fin beam	B1501-000	S = 12	1.5-2	M9500-100	B9500-48
	5	Attachment of tail gear box to helicopter frame	B1501-000	S = 19	8-9	M9500-101	B9515-11

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1	2	3	4	5	6	7	8
Trans- mission and tail rotor assembly	6	Attachment of tail rotor hub rear nut	B1501-000	splined nut	140-170	M9500-102	B9515-5
	7	Attachment of tail rotor hub front nut	B1501-000	Same	100-120	M9500-102	B9563-2
	8	Attachment of tail rotor blade	B1501-000	S = 46	30-35	M9500-101	B9515-6
	9	Attachment of tail rotor blade turn lever	B1501-000	S = 17	4-5	M9500-101	B9500-13
	10	Attachment of tail rotor blade counterweight	B1501-000	S = 17	4-5	M9500-101	B9500-13
	11	Attachment of lateral control hydraulic boost- er bracket to main gear box	B1504-50	S = 24	12-14	M9500-101	B9500-138
	12	Attachment of longitudinal control hydraulic booster EV-33A to bracket	B1504-50	S = 27	18-20	M9500-101	B9551-4 B9500-16
	13	Attachment of stabilizer control sector to main gear box	B5710-00	S = 19	7.5-8.5	M9500-101	B9500-136
	14	Attachment of stabilizer control bracket to main gear box	B5710-00	S = 19	7-8	M9500-101	M9500-95 B9500-136
	15	Attachment of stabilizer control bracket to main gear box	B5710-00	S = 30	7-8	M9500-101	M9500-95 B9500-141
	16	Attachment of lateral control hydraulic booster bracket to main gear box	B5104-00	S = 24	13-14	M9500-101	B9500-138
Control system assembly	17	Attachment of lateral control hydraulic booster EV-33A to bracket	B5104-00	S = 27	18-20	M9500-101	B9500-16 B9500-17

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1	2	3	4	5	6	7	8
Control system assembly	18	Attachment of worm gear mechanism	B5204-00	S=17	7.5-8.5	M9500-101	M9500-95 B9500-135
	19	Attachment of foot control hydraulic booster EV33A to base plate	B5204-00	S = 27	18-20	M9500-101	B9500-16 B9500-17 B9551-4
	20	Attachment of collective pitch control hydraulic booster bracket supports to gear box	B5904-00	S = 19	7-8	M9500-101	M9500-95 M9500-136
	21	Attachment of collective pitch control hydraulic booster	B5904-00	S = 36	48-53	M9500-102	B9500-154
	22	Attachment of foot control link-rod bracket to frame 1	B5200-00	S = 14	1.6-2	M9500-101	B9500-168 B9500-60
	23	Attachment of collective pitch control link-rod bracket to frame 1	B5900-00	S = 14	1.6-2	M9500-101	B9500-168 B9500-60
	24	Attachment of braces to main gear box	B0800-00	splined nut	40-50	M9500-102	B9508-2
Engines, main gear box and swash- plate assembly	25	Attachment of gear box mount to fuselage	B0820-00	splined nut	40-50	M9500-102	B9508-2
	26	Attachment of supplementary brace to main brace	B0820-00	S = 41	30-38	M9500-102	B9500-155
	27	Attachment of brackets to main gear box	B1501-000	S = 30	20-25	M9500-102	B9515-004
	28	Attachment of main rotor brake to main gear box	B1501-000	S = 17	5-6	M9500-101	B9515-9
	29	Attachment of main rotor brake drum	B1501-000	S = 17	9-10	M9500-101	B9500-135
	30	Attachment of CFC-90/360 gene- rators	B1501-000	S = 17	7-8	M9500-101	B9515-10

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1	2	3	4	5	6	7	8
Engines, main gear box and swash- plate as- sembly	31	Attachment of swashplate to main gear box	B1900-000	S = 30	20-25	M9500-101	B95I9-28
	32	Attachment of CIV-5-2.8 oil pressure warning unit bracket	B1501-000	S = 14	4.5-5.5	M9500-101	B9500-60
	33	Attachment of main rotor blade turning arm	B1911-000	S = 32	45-50	M9500-102	B95I9-3
	34	Attachment of hydraulic damper cap	B1910-600	S = 17	7-8	M9500-101	B9500-I3
	35	Attachment of main rotor blade	B1900-000	S = 60	15-20	M9500-101	B95I9-8
	36	Attachment of bearing flange of swashplate outer ring	B1920-000	S = 17	7-8	M9500-101	B9500-I3
	37	Attachment of bearing flange of swashplate inner ring	B1920-000	S = 17	7-8	M9500-101	B9500-I3
	38	Attachment of engines	B6410-00	S = 19	7-9	M9500-101	B9564-3
Ad- ditional drop tank as- sembly	39	Tightening of attachment bands	B6131-00	S = 19	4.7-5.3	M9500-101	B95I5-I
	40	Jointing of fuselage nose portion to cen- tral portion	B0101-00	S = 12	1.8-2	M9500-100	B9500-48
	41	Jointing of tail boom to fuselage central portion	B0101-00	S = 17	3.5-4	M9500-101	B950I-0I
	42	Jointing of tail boom to fuselage central portion	B0101-00	S = 19	6.5-7.0	M9500-101	B950I-3
	43	Jointing of pylon to tail boom	B0101-00	S = 14	3.5-4	M9500-101	B950I-2
	44	Attachment of front bracket to fan unit	B6310-00	S = 12	1.5-2	M9500-100	B9563-6
Fan unit as- sembly	45	Attachment of fan shaft shroud	B6310-00	S = 14	4-4.5	M9500-101	B9563-4
	46	Attachment of fan cardan shaft	B6310-00	S = 17	7-8	M9500-101	B9563-7

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1	2	3	4	5	6	7	8
Fan unit assembly	47	Attachment of braces to fan unit	B6310-00	S = 12	1.5-2	M9500-100	B9563-6
	48	Attachment of fan braces lower fittings	B6310-00	S = 12	1.5-2	M9500-100	B9563-6
Landing gear	49	Attachment of landing gear fit- tings to frame 1 of cargo compart- ment floor	50-0391-00	S = 12	1.55±0.15	M9500-100	B9500-48
	50	Attachment of landing gear fit- ting to frame 1' of cargo compart- ment floor	50-0391-00	S = 14	3.10±0.31	M9500-101	B9503-002
	51	Attachment of brace strut lower fitting to frame 18	B0392-00	S = 14	3.10±0.31	M9500-101	B9503-002
	52	Attachment of landing gear brace strut lower fitting to frame 18	B0392-00	S = 17	5.75±0.60	M9500-101	B9503-03
	53	Attachment of landing gear brace strut lower fitting to frame 18	B0392-00	S = 19	9.60±0.96	M9500-101	B9503-004
	54	Attachment of landing gear brace strut lower fitting to frame 22	B0393-00	S = 14	3.10±0.31	M9500-101	B9503-002
	55	Attachment of landing gear brace strut lower fitting to frame 22	B0393-00	S = 17	5.75±0.60	M9500-101	B9503-03
	56	Jointing of landing gear up- per attachment fitting to frame 18	B0355-00	S = 12	1.55±0.15	M9500-100	B9500-48
	57	Jointing of landing gear up-	B0355-00	S = 14	3.10±0.31	M9500-101	B9503-002

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1	2	3	4	5	6	7	8
Landing gear	58	per attachment fitting to frame 18 Jointing of landing gear upper attachment fitting to frame 18	B0355-00	S = 17	5.75±0.60	M9500-101	B9503-003
	59	Jointing of landing gear upper attachment fitting to frame 18	B0355-00	S = 19	9.60±0.96	M9500-101	B9503-004

X. LUBRICATION TABLE
OF TRANSMISSION COMPONENTS

Lubrication point No.	Description of lubrication points	Qty of lub. points	Oil or grease grade	Lubrication intervals	Note
1	2	3	4	5	6
1-2	Hinged joints of fan drive shaft	2	Hypoid gear oil, FOCT 4003-53	During installation on helicopter Every 50 hours	Inject oil through oil cup until excessive oil flows from valve
3	Main gear box filler neck	1	(a) in summer - mixture of 75% of MC-20 or MK-22 oil, FOCT 1013-49 and 25% of MK-8 or transformer oil, FOCT 982-53, by volume (b) in winter - mixture of 50% of MC-20 or MK-22 oil and 50% of MK-8 or transformer oil, by volume	Fill oil during installation on helicopter Check oil level before and after flight Replace oil every 50 hours	Four oil through funnel fitted with screen Check oil level by oil dipstick
4-16	Tail shaft splined joints	13	Hypoid gear oil, FOCT 4003-53	During installation on helicopter	Inject oil through any of two holes

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1	2	3	4	5	6
17	Intermediate gear box	1	In summer - hypoid gear oil, FOCT 4003-53 ; in winter - mixture of 2/3 of hypoid gear oil and 1/3 of AMP-10 oil, FOCT 6794-53	Every 50 hours Fill oil during installation on helicopter Check oil level before and after flight. Replace oil every 100 hours	located on flange until oil appears from other hole Fill oil through filler neck. Check oil level by oil dipstick
18	Tail gear box	1	Same	Same	Fill oil through breather plug hole. Check oil level by oil dipstick

XI. LUBRICATION TABLE
OF MAIN ROTOR AND TAIL ROTOR HUBS AND SWASHPLATE

Lubrication point No.	Description of lubrication points	Qty of lub. points	Oil or grease grade	Lubrication intervals	Note
1	2	3	4	5	6
1	Bearings of main rotor hub flapping hinge	5	Hypoid gear oil, FOCT 4003-53	During installation on helicopter After first 5 hours. Add oil every 25 hours	Fill oil through plug holes of hub body. Oil level should be 40-45 mm below outer edge of filling hole
2	Bearings of main rotor hub drag hinge	5	Same	During installation on helicopter. After first 5 hours. Add oil every 25 flying hours	Fill oil through plug hole in caps of fulcrum pins of drag hinges. Oil level should be 30-35 mm below outer edge of filling hole
3	Bearings of main rotor hub feathering hinge	5	In summer - MC-20 oil. In winter - MC-14 oil	During installation on helicopter. Replace oil after first 5 hrs.	Fill oil through plug hole in feathering hinge body (see Diagram) Oil level should be 30-35 mm below outer edge of filling hole.

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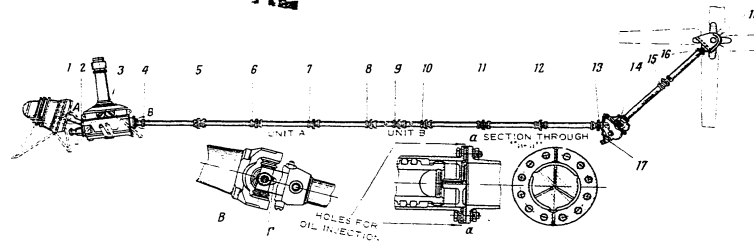


FIG. 27. LUBRICATION CHART FOR TRANSMISSION UNITS

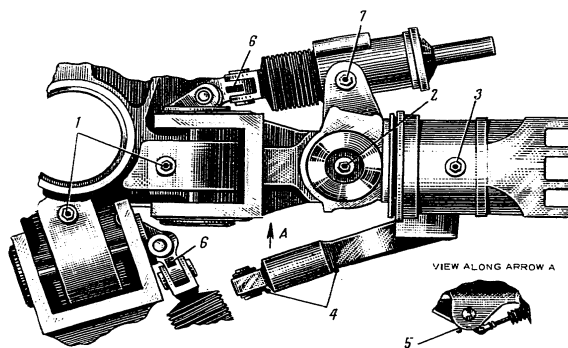


FIG. 28. LUBRICATION CHART FOR MAIN ROTOR HUB

Nos of lubrication points	1	2	3	4	5	6	7
Lubrication periods							
During installation on helicopter	*	*	*	*	*	*	*
After first 5 flying hours	*	*	*				
During post-flight inspection, every 12.5±2.5 flying hours							
During post-flight inspection, every 25 flying hours	*	*	*		*	*	*
Every 50 flying hours			*	*			
Every 100 flying hours							

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Area of lubrication points	8	9	10	11
Lubrication periods				
During installation on helicopter	*	*	*	*
After first 5 flying hours				
During post-flight inspection, every 12.5 flying hours		*		*
During post-flight inspection, every 25 flying hours				
Every 50 flying hours				*
Every 100 flying hours				

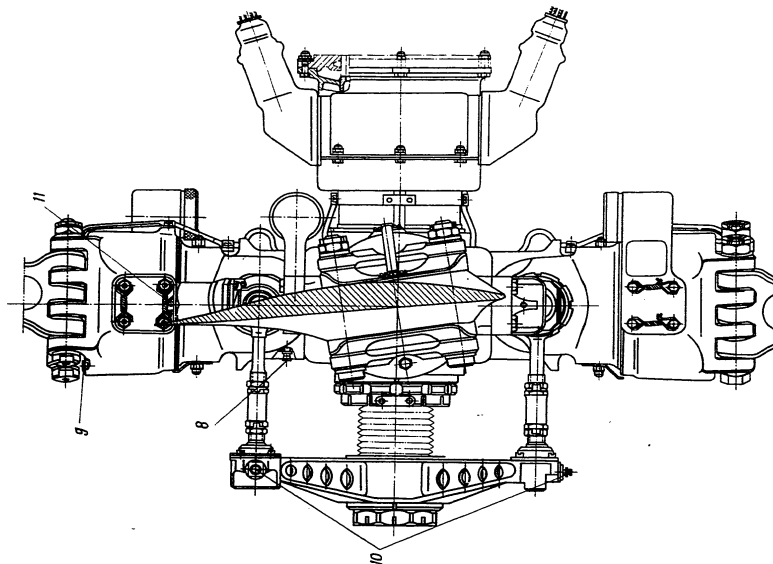


FIG. 29. LUBRICATION CHART FOR TAIL ROTOR HUB

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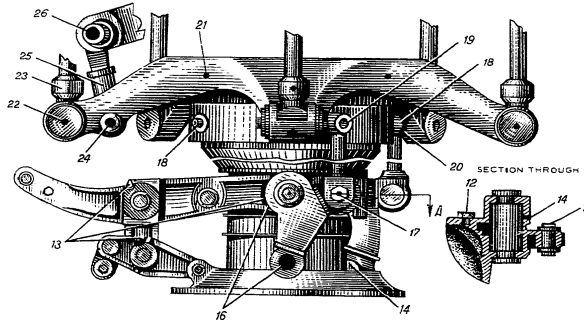


FIG. 30. LUBRICATION CHART FOR SWASHPLATE

No. of lubrication points	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Lubrication periods															
During installation on helicopter	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
After first 5 flying hours															
During post-flight inspection, 12.5±2.5 flying hours				*		*		*	*						
Every 25 flying hours	*									*					
Every 50 flying hours		*	*		*		*				*	*	*	*	*
Every 100 flying hours															

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1	2	3	4	5	6
				Add oil every 25 hours Replace oil every 50 hours	
4	Bearings of blade turning arm	2x5 10	LMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 50 hours	Inject grease through oil cup until grease appears from check holes
5	Pawl pivot pin sleeve	5	LMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 25 hours	Inject grease until it leaks through glands
6	Bearings of damper attachment shackle	5	LMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 25 hours	Inject grease through oil cup. Check grease injection after first two strokes of plunger until grease leaks between oil cup ball valve and valve seat. If necessary, connect grease gun again and add grease as required
7	Bearings of hydraulic damper attachment bracket	2x5=10	LMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 25 hours	Same
8	Bearings of tail rotor hub flapping hinge	4	Hypoid oil, FOCT 4003-53	During installation on helicopter. Add oil every 25 hours	Inject oil through oil cup mounted on hub body until it flows from relief valves
9	Bearings of tail rotor hub feathering hinge	4	In summer - MC-20 oil In winter - MC-14 oil	During installation on helicopter. Add oil every 25 hours	Fill warm oil through plug hole in butt end of feathering hinge sleeve, other plug located in symmetry with the former being removed. Fill oil until it reaches plug hole thread
10	Hinged joint of tail rotor spider	4	LMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 50 hours	Inject grease through oil cup

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1	2	3	4	5	6
11	Bearings of turn lever of tail rotor blade	4	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 50 hours	Inject grease through oil cup
12	Swashplate slide bush AH	1	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 25 hours	Inject grease through oil cup until it flows from relief valve
13	Bearings of collective pitch lever	1	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 50 hours	Inject grease through oil cup
14	Antifriction bearings of longitudinal control bell crank	2	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 50 hours	Inject grease through oil cup mounted on bell crank and pin
15	HC-55 bearings of longitudinal control bell crank (in joint with link-rod connected to swashplate ring)	1	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 15 hours	Inject grease through oil cup of pin
16	Antifriction bearings of lateral control bell crank	2	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 50 hours	Inject grease through oil cups of bell crank and pin
17	HC-55 bearing of lateral control bell crank in joint with link-rod connected to swashplate ring	1	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 10+5 hours	Inject grease through oil cup of pin
18	Bearings of swashplate ring gimbal	3	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 50 hours	Inject grease through oil cups of pins (one oil cup is accessible through inner space of pin of longitudinal control link-rod)
19	Bearing of swashplate ring gimbal and HC-55	1	UMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease	Inject grease through oil cup of pin

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1	2	3	4	5	6
	bearing of lateral control			every 10+5 hours	
20	HC-55 bearing of longitudinal control link-rod		HMATM-201 grease, FOCT 6267-52	During installation on helicopter. Add grease every 10+5 hours	Inject grease through oil cup of bracket
21	Bearing of swashplate ring	5	HMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 25 hours	Inject grease through oil cup of swashplate ring until it appears from by-pass valve. When lubricating, turn swashplate ring
22	Bearings of swashplate ring end hinges	2x5=10	HMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 50 hours	Inject grease through oil cups of bearing caps
23	Bearings of blade turning rods	5	HMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 50 hours	Inject grease through oil cup
24	Bearings of guide fork	1	HMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 50 hours	Inject grease through oil cup of swashplate ring
25	Bearings of guide arm	1	HMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 50 hours	Inject grease through oil cup of arm
26	Bearings of guide shackle	4	HMATM-201 grease, FOCT 6267-52	During installation on helicopter. Every 50 hours	Remove bearing caps and fill bearings with grease

Note. In case of oil leakage from the hinges of the main and tail rotor hubs check oil level and if necessary, add oil during the pre-flight inspection procedure.

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XII. LUBRICATION TABLE
OF CONTROL SYSTEM, HYDRAULIC SYSTEM AND
LANDING GEAR

Nos	Description of lubrication points	Lubrication intervals	Lubricant	Note
1	Closed-type bearings in linkage of flight and engine controls (from collective pitch and throttle control levers, cyclic pitch levers, and pedals - to hydraulic boosters and HP-23 pumps)	50 hrs	HMATM-201	Renew corrosion-preventive grease on protective washers
2	Control wire ropes of tail rotor and stabilizer	25 hrs	CT (HK-50)	Renew grease on textolite blocks
3	Bearings of landing gear wheels	100 hrs but not less than every 200 landings	CT (HK-50)	Replace grease
4	Hinged joints of landing gear	50 hrs	HMATM-201	Inject grease through oil cups
5	Landing gear shock struts	Every 3 years	AMT-10	Replace oil
6	Hydraulic reservoirs	Every 6 months but not less than every 100 operating hours	AMT-10	Replace oil
7	Fittings for jointing and attachment of wing to PWK-1 mechanism	50 hours	HMATM-201	Inject grease
8	Stabilizer control mechanism	25 hrs	Same	Inject grease
9	Bearings of longitudinal and lateral control link-rods located after hydraulic booster	50 hrs	Same	Wash and lubricate
10	Swing bolts of attachment fittings of loading doors and ramps in cargo compartment	50 hrs	Same	Wash and lubricate

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1	2	3	4	5
11	Hinged joints of work platforms and shutters of engines and gear box compartment cowls	50 hrs	UMATYM-201	Wash and lubricate
12	Hinged joints of engines and fan unit control link- rods and bell cranks	50 hrs	Same	Wash and lubricate

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Chapter V

OPERATION OF HELICOPTER IN FLIGHT

I. OPERATION OF POWER PLANT, TRANSMISSION AND HYDRAULIC SYSTEM

1. Before flight and during the entire flight it is necessary to check that the readings of the instruments of the power plant and transmission conform to those indicated in Table No.1.
2. The fuel pressure before burners should be 22-53 kg/sq cm.
3. The pressure in the main hydraulic system should be 120 ± 5 - 155 ± 5 kg/sq cm. In this case there should be no pressure in the duplicating hydraulic system.
4. The A.C. generators installed on the helicopter are the main power supply sources for the de-icing system only. For other electric power consumers these generators are reserve power sources and should be switched on only in case single-phase or three-phase invertors fail.

II. OPERATION OF FUEL SYSTEM ⁽³⁷⁾

1. Irrespective of the variants of fuel tanks filling (including the external tanks) the sequence of fuel consumption remains unchanged and should conform to the requirements indicated in Table No.3.
 2. The sequence of fuel tank consumption in flight is governed even by a slight change of helicopter balancing as the fuel is being used up.
 3. As the fuel is being used up, the connection of fuel tank groups may be performed either by automatic or manual engagement of booster pumps.
 4. To ensure automatic control of fuel consumption it is necessary to turn on the automatic control circuit-breaker and set the switch CONSUMPTION CONTROL in AUTOMAT. position.
 5. The automatic control of fuel consumption should be checked by flashing of fuel tank group booster pump pilot lamps.
- When the fuel consumption automatic control system functions properly, the pilot lamps of the booster pumps should come on in conformity with the sequence of fuel consumption. Depending on flight conditions (different bank and pitch angles) the automatic changeover from group IV to group III may occur when the fuel content indicator of group IV reads from 0 to 75 kg. for a period of 3 minutes.

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Table 3

Quantity of fuel filled, liters	HELICOPTER FUELLING AND CONSUMPTION SEQUENCE WITH MANUAL CONTROL OF PUMPS	
12655	Engage pump of tank No. 9. After emptying of tanks Nos. 9 and 10 switch on pumps of tanks Nos. 11 and 7. After emptying of external tanks and tanks Nos. 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 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815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000, 1001, 1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031, 1032, 1033, 1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041, 1042, 1043, 1044, 1045, 1046, 1047, 1048, 1049, 1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1059, 1060, 1061, 1062, 1063, 1064, 1065, 1066, 1067, 1068, 1069, 1070, 1071, 1072, 1073, 1074, 1075, 1076, 1077, 1078, 1079, 1080, 1081, 1082, 1083, 1084, 1085, 1086, 1087, 1088, 1089, 1090, 1091, 1092, 1093, 1094, 1095, 1096, 1097, 1098, 1099, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1123, 1124, 1125, 1126, 1127, 1128, 1129, 1130, 1131, 1132, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1141, 1142, 1143, 1144, 1145, 1146, 1147, 1148, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1161, 1162, 1163, 1164, 1165, 1166, 1167, 1168, 1169, 1170, 1171, 1172, 1173, 1174, 1175, 1176, 1177, 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2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 21	

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WARNING. Supply of fuel from tanks group III to group V should start not immediately after emptying of group IV but after consumption of 50-100 kg of fuel from group V.

Note. In case of automatic control of fuel consumption the booster pumps of empty fuel tank groups may periodically come in operation but this is not an indication of malfunctioning of the automatic control system and in no way interferes with its operation and continuation of flight.

6. In case the automatic control system fails it is recommended to set the switch CONSUMPTION CONTROL in MANUAL position and engage manually the booster pumps of the fuel tank groups in conformity with the sequence of fuel consumption. In this case after emptying of any group of tanks it is necessary to disengage the booster pump of the particular group.

7. While in flight, the quantity of fuel remaining in the tanks should be checked by the fuel content gauge. When the quantity of fuel in tank 11 lowers to 400 kg, the fuel low level warning lamp on the flight engineer's instrument board and the light panel located on the pilot's instrument board should start burning.

Note. When the warning lamp comes on it indicates that the total emergency fuel remainder (including the fuel left in reserve tank No.1) is 800 kg.

8. If the booster pumps of the tank groups are engaged manually, the fuel consumption from the tanks should be checked by the fuel content gauge. The pumps are switched on or off depending on consumption of fuel from the tanks.

Note. In case of manual control of fuel consumption the green lamp indicating the operation of the pumps in the lower tank groups may start flickering when the quantity of fuel remaining in these tanks is 155-195 kg. This is not an indication of malfunctioning of the fuel consumption manual control system and in no way interferes with continuation of the flight.

9. When the helicopter engines are running, the tanks of group IV are filled with fuel flowing through the open stop cocks.

This group of tanks is replenished with fuel at a rate of 120 litres per hour (60 litres per hour through each stop cock).

The quantity of fuel fed through the stop cock to the tanks of group IV depends on flight duration.

To ensure more efficient consumption of fuel and maintaining of the helicopter balance within the allowable limits up to the moment of landing with a fuel reserve equal to or less than the emergency one it is necessary to empty the tanks of group IV. To achieve this, proceed as follows:

- when the quantity of fuel left in tank No.11 (group V) is from 1000 to 800 kg, set the switch of fuel consumption control system to MANUAL position and then shift it again to AUTOMATIC position.

With the switch in AUTOMATIC position the pump of group IV engages and picks up the fuel accumulated in this group of tanks. After this the automatic system ensures further consumption of fuel in the established sequence.

Note. To ensure complete consumption of fuel during long-term hovering flight it is recommended to engage the pumps of tanks Nos 8, 6, and 3 instead of pumps of tanks Nos 7, 4, and 2.

III. OPERATION OF DE-ICING SYSTEM

Before flight switch on the circuit breakers of the right and the left generators.

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1. When the helicopter approaches a zone of possible icing (2-3 minutes before entering the icing zone) the de-icing system should be switched on for a cycle of 20 sec , 40 sec , or 60 sec depending on the ambient air temperature. (2)

If the ambient air temperature is above -5°C , the de-icing system should be switched on for a heating cycle of 20 sec ; if the temperature is from -5 to -10°C - for a cycle of 40 sec ; if the temperature is below -10°C - for a cycle of 60 sec.

When the helicopter suddenly enters the icing zone (as indicated by formation of ice on glass panels, vibration or other signs of icing) the de-icing system should be switched on for 60 sec and in case of abnormal behaviour of the helicopter the icing zone should be left immediately.

2. After leaving the icing zone the de-icing system should be switched off i.e. the switch should be set in the neutral position.

3. During ground test-running of engines, taxiing and take-off from airfields not cleared from stones and other foreign objects, the leading edge portion of the main rotor sections may be damaged by foreign objects picked up by the air flow which is created by the revolving main rotor.

These defects may cause short-circuiting in the electric heaters system of the main rotor de-icing system.

The possible defects of this system should be detected in due time, especially when the flight is to be performed in icing conditions. Before performing a flight mission it is necessary to check functioning of the de-icing system of the main rotor blades in the hovering flight.

To effect this, switch on the de-icing system for a cycle of 40 sec and measure the current by the ammeter located on the flight engineer's panel.

In this case the current should be 220-270 A in positions "1+2" and "3+4" and 110-135 A in position "5".

If the current does not conform to the above indicated values the flight with the energized de-icing system of the main rotor is not allowed. The de-icing system should be switched off, the helicopter landed and the trouble corrected. (2) (4)

IV. LOADING, ARRANGEMENT, ATTACHMENT, TRANSPORTATION, AND UNLOADING CARGOES

1. To maintain the helicopter balancing in flight within the allowable limits (from +360 to -200 mm), all the loads carried inside the helicopter should be placed in conformity with the marks stencilled in the cargo compartment.

All the cargo handling, attachment, and removable equipment carried in the helicopter should be placed in the front part of the cargo compartment, depending on the location of the basic loads.

2. All materiel and loads carried inside the helicopter should be reliably tied down. The suspension systems of the wheeled vehicles should be released.

3. During transportation of various materiel and loads the helicopter should be loaded in conformity with instructions set forth in Para 1 and the data contained in the Tables below for the crawler-mounted and wheeled vehicles as well as in conformity with the allowable equally-distributed loads for the cargo compartment floor (see Fig.31).

Note. Never place loads in the compartment behind group 4 of fuel tanks.

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CONFIDENTIAL(1) Crawler-Mounted Vehicles

Length of crawler bearing surface (L, mm)	Width of crawler bearing surface (B, mm)	Allowable maximum weight of vehicle (G, kg)
1100	220	2700
	300	3700
	400	5000
	500	6200
1300	220	3200
	300	4400
	400	5800
	450	6400
1500	220	3700
	300	5000
	350	6000
	400	6400
2000	220	5000
	250	5600
	300	6400

Note. Intermediate values of the crawler bearing surface width should correspond to the respective intermediate values of the maximum allowable weight.

(2) Wheeled Vehicles

Type of vehicle	Gauge, mm	Maximum allowable weight of vehicle, kg	To be installed between frames Nos
1	2	3	4
Single-axle (two-wheel) vehicles	800-1400	1200	1-14
Same	800-1400	1200	18-26
Same	1440 and more	2400	1-11
Same	1440 and more	2800	11-26
Two-axle (four-wheel) vehicles	800-1440	1500	1-14
Same	800-1440	1500	18-26
Same	1440 and more	3000	1-11
Same	1440 and more	3500	11-26
Two-axle vehicles with one central wheel (three-axle)	800-1440	1500	1-14
	800-1440	1500	18-26

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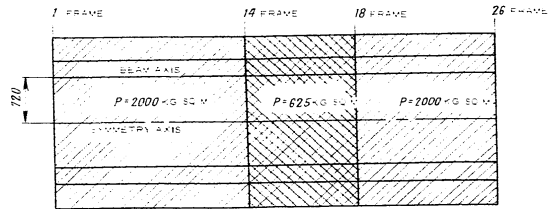
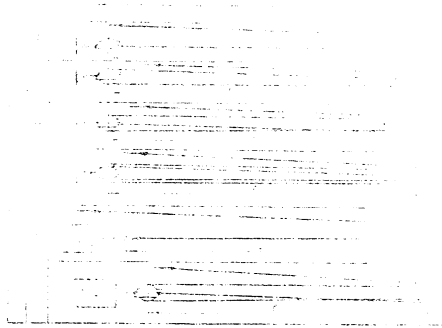


FIG. 51. ALLOWABLE EQUALLY-DISTRIBUTED LOAD ON CARGO COMPARTMENT FLOOR



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1	2	3	4
Two-axle vehicles with one central wheel (three-axle)	1440 and more 1440 and more	2800 3000	1-11 11-26
Three-axle (six-wheel) vehicles		2700	1-14
Same	800-1440	2700	18-26
Same	1440 and more	5300	1-11
Same	1440 and more	6200	11-26

Notes: 1. For two-wheel vehicles fitted with one central wheel the load on the central wheel should not exceed 500 kg.
 2. Maximum allowable weight for wheeled vehicles is calculated for pneumatic tyres of the following dimensions:
 (a) wheel diameter 550-1200 mm;
 (b) wheel width 160-250 mm.

To prevent local damage to the cargo compartment floor and ramps it is necessary to lay wooden boards under pneumatic tyres and small-diameter wheels.

5. The passengers should be seated in the helicopter cargo compartment in conformity with seat numbers. The seats are numbered as follows:

- port side: odd numbers from No.1 to No.29 (as counted in aft-to-fore direction);
- starboard: even numbers from No.2 to No.30 and No.31 (as counted in fore-to-aft direction).

The air-borne passengers are not allowed to change seats in flight. (22)

6. The loads and materiel are rolled into the helicopter by means of the MHP-3 winch located in the cargo compartment under the threshold of the crew cabin and the B9220-900 pulley block. The winch is controlled with a portable control panel stowed in a special bag located on the port side of the helicopter near the front entry door.

Prior to loading, the winch wire rope is pulled out manually (by an effort of 10-15 kg) to a required length. Depending on the weight of the load to be placed aboard the helicopter the winch may be driven either manually or by one or two electric motors. The maximum effort of the winch applied to the wire ropes is 800 kg. In case of manual drive the effort applied to the wire rope is within 300 kg.

To pick up loads in hovering flight the helicopter is provided with the MHP-3 lifting winch. In this case the winch wire rope is passed through a special system of pulley blocks mounted on a special truss inside the fuselage. The loads are picked up through the hatch in the cargo compartment floor.

A. Preparation of Helicopter for Loading

1. Preparation of the helicopter for loading is carried out by the crew technicians.

2. Preparation of the helicopter for transportation of materiel and loads consists in the following:

- the helicopter should undergo preliminary and pre-flight preparation in conformity with the flight mission as stated in the Air Force Technical Manual and the Mx-6 Helicopter Operating and Maintenance Instructions;

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- the helicopter cabin should be free of equipment not related with the loads to be transported;
 - all the cargo handling and attachment equipment intended for transportation of the particular type of materiel and loads should be placed aboard the helicopter.
3. During preparation of the helicopter for loading make sure that:
- the helicopter is reliably held in place by the parking brake;
 - the wheels of landing gear are chocked;
 - the helicopter is properly grounded.
- Besides, perform the following operations:
- open the cargo compartment door;
 - assemble the system of pulley blocks in compliance with the reeving diagram (Fig.32);
 - check functioning of the control mechanism of the HVM-I winch (manipulate the control switch of the HVM-I winch and apply an effort to the wire rope trying to release it or wind up round the drum);
 - if necessary, install special mechanical jacks of B9930-00 type under frame 22. ⁽²⁾

B. What Crew Members should Do during
Loading Operations

1. The pilot (crew commander) is authorized to do the following:
 - control loading (unloading) of the helicopter cargo compartment;
 - check the helicopter balancing and reliability of attachment of loads in the compartment.

During loading (unloading) the crew commander should keep a watch on correct passage of the materiel or loads through the cargo hatch and inside the cargo compartment and discontinue the loading operation when it appears necessary; besides, the crew commander checks that the loading team observes the safety rules during operation.

2. The co-pilot should check the helicopter balancing and reliability of load attachment together with the crew commander.

3. The flight engineer is responsible for serviceability of the loading and attachment equipment, correct and reliable operation of the winch and the pulley blocks as well as arrangement and attachment of loads in the cargo compartment in compliance with the loading diagram.

Loading Team

Loading and attachment of loads in the helicopter is performed by a team of 4-6 men (depending on overall dimensions and weight of loads). All members of the loading team should strictly observe the safety rules adopted for rigging operations.

Positioning of Loading Team
Members

During the loading operation two men (one man) should stand in front and behind the load (vehicle) to be rolled into the helicopter. Two other men provid-

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ed With type B9220-140 wedge blocks keep the load from rolling down in case of breakage of the winch loading wire rope; (when rolling two coupled vehicles into the cargo compartment the wedge blocks should be placed under the wheels of the front vehicle); two men (one man) steer the wheels of the vehicles or the loads.

C. Loading Procedure

1. All materiel and loads are placed into the helicopter primarily through the cargo hatch over the ramps. Small items may be loaded through the front and rear doors located on the port side of the helicopter.

When it appears necessary, the self-propelled vehicles are allowed to enter the cargo compartment by their own power; in this case it is necessary to strictly observe fire safety rules and take measures to prevent the helicopter parts from damage.

2. Before beginning of the loading operation the wire ropes should be reeved through the pulley blocks in conformity with the diagrams illustrated in the Table (see Fig.32) and depending on the weight of the load.

3. To reduce loading speed when rolling in bulky items it is recommended to follow the reeving procedure given in diagram No.5.

4. If loads are to be pulled in without the pulley block use a hook fitted with B9220-600 shackle and B9220-630 and B9220-890 wire rope slings or without them.

Note. If a load cannot be pulled to the required place by the winch, the former should be arranged in the compartment by the loading team.

5. Prior to loading, all the materiel should be placed along the symmetry axis of the helicopter, if possible.

6. The choice of the method for attaching the materiel and loads to a movable pulley or the end of the wire rope (when loading is effected without the pulley block) depends on construction of the materiel to be loaded and possibility of attaching loading devices to the materiel.

To reduce the unloading time it is recommended not to disconnect the towing devices from the vehicles placed aboard the helicopter.

7. When loading crawler-mounted vehicles it is necessary to lay wooden boards on the cargo compartment floor.

8. When loading three-wheel vehicles it is recommended to install the medium and tail ramps B0752-10 and B0752-40. In the course of loading, see that the towing wire rope is symmetrically attached to the materiel to be loaded, check that the gaps between the helicopter boards and the loaded materiel are approximately equal, and make sure that the movable pulley of the block does not touch the fixed pulley.

D. Arrangement of Loads Inside Helicopter

1. The materiel and loads to be carried in the helicopter cargo compartment should be arranged and attached in strict compliance with the loading diagrams.

2. When the allowable specific pressure on the floor of the cargo compartment exceeds the prescribed limits it is necessary to install 50-9220-250 load distributors or B9220-390 load distributor shoes. The allowable loads for the cargo compartment floor and ramps during loading and transportation are indicated in Fig.31.

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3. Arrangement of materiel in the cargo compartment of the helicopter is specified in the transportation diagram and determined by the distance from the vehicle wheel axle to the first frame of the fuselage. The precision of load location should be within 250 mm.

4. The distance from the first frame is determined by the straight line drawn on the starboard of the fuselage and graduated in metres.

5. After arrangement of vehicles on their places it is necessary to lay B9220-140 chocks under the vehicle rear wheels.

6. Loads consisting of separate items should be arranged in symmetry with the longitudinal axis of the helicopter and stowed so as to preclude any displacement after their attachment.

7. The personnel accompanying the loads should be placed in the helicopter cargo compartment on seats indicated on the transportation diagram for the particular load.

E. Attachment of Loads

1. All vehicles and loads are attached to the floor of the helicopter cargo compartment by means of tie-down wire ropes B9260-50.

2. Small items are attached to the helicopter floor by means of tie-down nets B7904-00. *and B7904-20*

3. When attaching vehicles and loads be sure to fit a piece of a durite hose to the tie-down wire rope where it contacts the load.

In places of wire rope sharp bends it is recommended to install wooden spacers.

4. Vehicles and loads should be tied down in the following way:

- install all the tie-down ropes in conformity with the load attachment diagram;
- tighten up preliminarily the wire rope by means of a wedge mechanism;
- tighten up finally all the wire ropes by means of turnbuckles.

Note. All the wire ropes should be equally tightened; to this end it is recommended to alternately tighten up the opposite wire ropes.

5. When installing tie-down nets tighten up alternately opposite belts.

Each belt is tightened up by two men of the loading team. All the belts should be tightened up manually with an equal effort. The free ends of the tie-down net belts should be wound up in reels.

F. Unloading Procedure

1. Unloading of vehicles and loads is the reverse of loading.

2. Separate light-weight items are unloaded manually.

3. All vehicles and loads mounted on trolleys and carts are usually rolled out from the cargo compartment manually, being, however, by all means held by the winch wire rope. In this case the winch uncoils the wire rope.

4. Self-propelled vehicles may move from the cargo compartment at low speed by their own power. In this case it is necessary to observe fire safety measures adopted for starting engines of self-propelled vehicles.

Weight and Balance Calculations

The helicopter is balanced only in the longitudinal direction because vertical balancing is of no significance in operation.

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The lateral C.G. limits of the helicopter are usually not calculated but it should be remembered that the loads must be placed in the helicopter cargo compartment symmetrically.

If loads in the helicopter are arranged not symmetrically with respect to the helicopter longitudinal axis the permissible moment should not exceed 4000 kg-m.

The C.G. limits of an empty helicopter are located within - 321 mm (aft of the main rotor axis).

The permissible C.G. limits of the helicopter range from +360 mm (forward of the main rotor axis) to -220 mm (aft of the main rotor axis).

The aft C.G. location of the loaded helicopter in all variants is -200 mm.

When the quantity of fuel is reduced, the cargo compartment of the helicopter may be used for transportation of about 12 tons of load (including the weight of the cargo handling and attachment equipment).

V. OPERATION OF HEATING AND VENTILATION SYSTEMS

(1) Heating System

1. The helicopter cabins are heated by air warmed in the air-to-air heat exchangers. The air is fed into the air-to-air heat exchangers by means of a fan (article 1155B) from atmosphere or from the cargo compartment depending on the temperature conditions.

The heat exchangers are heated by air forced by the fan of the main gear box into the shrouds of the exhaust pipes where the air is heated. The warm air flows through the air trunks into the air-to-air heat exchangers, warms them up and escapes into the atmosphere. The air for heating cabins and blowing glass panels is fed into the heat exchangers through separate isolated channels. This ensures supply of clean air for cabin heating.

2. Air intake for heating of the helicopter cabin is adjusted by shutters which are remotely controlled by the pneumatic-operated valve. Access of air into the shrouds of exhaust pipes for heating is obtained by a shutter controlled by the GMECO-M solenoid-operated valve linked with the air-actuated cylinder.

3. To engage the heating system of the helicopter cabins, it is necessary to set the H3HH-20 switch located on the flight engineer's control panel to the required position. As a result, the air will be drawn from the helicopter cargo compartment when the switch is in HEATING (ОТОПЛЕНИЕ) position or from the atmosphere when the switch is in VENTILATION WITH HEATING (ВЕНТИЛЯЦИЯ С ОБОТРЕВОМ) position.

4. To supply warm air into the helicopter cabins, proceed as follows:

- (a) in the cargo compartment:
 - set the shutter handle in OPEN position (the handle is located on the vertical heating box at frame No.7);
- (b) in the pilots' and navigator's cabins:
 - set the handles of the warm air control shutters located behind the seats of the co-pilot and the navigator in OPEN position;
- (c) in the flight engineer's cabin:
 - set the handle of the warm air control shutter located on the floor near the flight engineer's seat in OPEN position.

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Ventilation

1. The crew cabins and cargo compartment of the helicopter are ventilated by air forced through the same trunks used for warm air supply with the aid of the fan (article 1155E) with shutters of the T-pipes closed. In this position the shutters prevent access of hot air into the air-to-air heat exchangers.

2. The cargo compartment is additionally ventilated by means of the main gear box fan.

3. The air from the cargo compartment passes through the ventilation slots made in the form of louvres and located on the right loading door. The slots are closed with a shutter from the inner side of the cabin.

4. To engage the ventilation system of the crew cabins and cargo compartment proceed as follows:

- set the ПЗНН-20 switch located on the flight engineer's control panel in VENTILATION (ВЕНТИЛЯЦИЯ) position;
- set the handles of the warm air control shutters located behind the seats of the co-pilot, navigator and the flight engineer in OPEN position;
- besides, set the handle of the ventilation system shutter located in the cargo compartment to a required position.

VI. HEATING GLASS PANELS OF PILOTS' AND NAVIGATOR'S CABINS

1. The glass panels of the pilots' and navigator's cabins are heated by current-conducting heating films. The heating elements are switched on and off automatically by means of the AOC-81M relay.

2. To engage the heating elements of the glass panels, proceed as follows:

- turn on the toggle switch of the A3C-2 circuit breaker located on the pilots' upper panel;
- turn on the GLASS HEATING switch (B-45) located on the electric panel of the co-pilot.

3. Functioning of the heating elements is checked by hand-feel with the cabin heating system disengaged.

4. In addition to electrical heating

two central front glass panels of the pilots' cabin are heated with warm air supplied from the main trunk for heating the cabins. When the ventilation system is switched on, the glass panels are blown with cool air and the cabins are ventilated.

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Chapter VI

OPERATION OF HELICOPTER IN WINTER

Winterization of the helicopter should be performed when the ambient air temperature lowers and keeps steadily below +5°C.

The winterization procedure is as follows:

1. Perform the scheduled maintenance operations.
2. Check functioning of the helicopter de-icing system.
3. Drain oil from the gear boxes and fill them with the lubricant specified for winter operation (see Chapter III "Servicing Helicopter Systems").
4. Replace grease in feathering hinges of the tail rotor hub by MC-14 oil.
5. Replace grease in feathering hinges of the main rotor hub by MC-14 oil.
6. Adjust tension of the control wire ropes of the tail rotor and the stabilizer in conformity with the respective graphs.
7. Fit blanking covers for inlet and outlet ducts.
8. Check the heating system of the cargo compartment.
9. Check the heating system of the crew cabin.

I. PECULIARITIES OF ENGINE OPERATION IN WINTER

When operating engines in winter time observe the following rules:

1. Never start the engine if the elements of the air intake are covered with ice.
2. If the engine is to be parked at ambient air temperatures below -40°C, be sure to drain the oil from the engine immediately after its stopping.
3. Prior to engine starting at ambient air temperatures below -40°C fill the tank with oil heated to a temperature of +60 to 80°C.
4. When starting the cold engine, do not allow the oil pressure to rise above 6 kg/sq cm.
5. Take care to protect fuel and oil from penetration of moisture.
6. When operating the engine in conditions which may cause icing do not let the engine run at the idling rating for more than 10 minutes if the oil temperature at the engine inlet is below 40°C.

When it appears necessary to operate the engines in the above conditions, the engine should be warmed up at 0.85 normal rating until the temperature at the engine inlet reaches 60-70°C. (24)

Note. At subzero ambient air temperatures it is allowed to reduce the compressor speed at the idling rating to 5100 r.p.m. (48.0%).

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II. PECULIARITIES OF MAIN GEAR BOX OPERATION IN WINTER

Prior to starting the engine in winter check the oil grade filled in the gear box. If the gear box is filled with summer grade oil, the engine may be started without heating the gear box at the oil temperature in the oil sump not below -8°C . If the gear box is filled with winter grade oil, the engine starting (without heating of the gear box) may be carried out at the oil temperature in the oil sump not below -22°C .

After starting the engine the gear box should be warmed at speeds used for warming up the engine. If the oil temperature in the gear box oil sump is below the limits allowable for starting without warming, the gear box should be heated with warm air until the oil temperature in the oil sump is 5°C higher than that indicated for starting without warm-up procedure. To ensure efficient heating of the P-7 gear box, the hot air from the heating stove should be directed upwards to the oil sump, especially where the KHP-23 oil pump, free-wheeling clutch, and the oil cooler are located.

In all other respects the operation of the gear box in winter does not differ from its operation at above-zero temperatures of the ambient air.

When the ambient air temperature drops below -22°C it is necessary to perform the following operations after stopping the engines and the main rotor to avoid solidification of oil in the *oil coolers* and oil pipe-lines:

- (a) screw off the drain plugs of the oil coolers;
- (b) connect a special drain hose to the drain valve of the main gear box and drain off 45-50 litres of oil. ⑤

III. OPERATION OF INTERMEDIATE AND TAIL GEAR BOXES

1. When the ambient air temperature drops to $+5^{\circ}\text{C}$, it is necessary to drain oil from the intermediate and tail gear boxes and fill them with diluted oil composed of 2/3 of hypoid gear oil (TOCT 4003-53) and 1/3 of AMP-IO oil (TOCT 6794-53) by volume.

2. When operating the gear boxes on diluted oil it is allowed not to heat up the intermediate and tail gear boxes before starting at ambient air temperatures of -35°C .

3. Before starting at ambient air temperatures below -35°C , it is recommended to heat the intermediate and tail gear boxes until the oil temperature in them is above -20°C .

4. When the ambient air temperature rises and keeps steadily above $+5^{\circ}\text{C}$, it is necessary to drain the diluted oil from the intermediate and tail gear boxes and fill new hypoid gear oil.

In case of a sudden temperature change it is allowed to operate the gear boxes on diluted oil at ambient air temperatures of up to $+25^{\circ}\text{C}$.

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Chapter VII

OPERATION OF FIRE FIGHTING EQUIPMENT

1. The fire fighting equipment of the helicopter provides for extinguishing fire in the following separate compartments:

- left engine compartment;
- right engine compartment;
- gear box compartment;
- bays of front fuel tanks (groups I and II);
- bay of rear fuel tanks (group III);
- bay of upper fuel tanks (groups IV and V).

2. To extinguish fire, the helicopter is provided with eight OC-8M fire extinguishers charged with fire-extinguishing compound "3.5", of which fire extinguishers 1, 2, 3, and 4 make up the automatic series and are discharged automatically or by depression of the push button whereas four other fire extinguishers - 5, 6, 7, and 8 make up the other, non-automatic series, and are discharged only by depression of the push button.

3. Installed in spots of potential fire are fire detectors, type ДСП-ІАГ, (9 groups). In case of fire the thermal electromotive force induced in the fire detectors feeds a signal to the actuating unit. The latter operates and feeds a signal through the interlocking relay to the valve unit.

The operations caused by this action are as follows:

(a) the fire fighting valve of the respective compartment in the valve unit opens and the pilot lamp (located on the flight engineer's control panel) comes on, thereby indicating the location of fire. At the same time the light panel FIRE (ПОЖАР) located on the pilots' central panel of the instrument board starts burning (without indication of fire location);

(b) the explosive cartridges of all the four automatic discharge extinguishers explode and the fire-extinguishing compound is discharged into the area set on fire. At the same time four warning lamps located on the flight engineer's control panel come on, thereby indicating that the fire extinguishers have been discharged.

The fire warning lamps located on the flight engineer's control panel go out after smothering fire in all compartments except the engine compartment where the warning signal is intentionally delayed due to special adjustment of the electric system. After extinguishing fire in the engine compartment the fire warning lamps are switched off by depression of the КНН push button. CUT OUT OF FIRE WARNING LAMPS (ВЫКЛЮЧЕНИЕ СИГНАЛА ПОЖАРА).

4. In case the automatically discharged fire extinguishers fail to smother the fire the flight engineer can supply the fire-fighting compound to the same location from four other fire extinguishers by depression of the push button

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SECOND ACTUATION. In this case four red pilot lamps located on the flight engineer's control panel start burning, thereby indicating that the manually controlled fire extinguishers have been discharged.

5. If fire occurs in the engine compartment, the flight engineer should immediately report the trouble to the crew commander and take adequate measures for smothering the fire in accordance with the commander's instructions. These measures are as follows:

- close the fuel shut-off valve of the fuel system of the engine in whose compartment the fire has broken out (the fuel shut-off valves are opened and closed by the switches located on the flight engineer's control panel);
- make sure that the air blow-off bands of the engine have closed as indicated by the pilot lamp. If the air blow-off band has failed to close automatically, it should be closed by setting a respective toggle switch in a required position;
- depress the KHH push button CUT OUT OF FIRE WARNING LAMPS. As a result, the fire warning lamp should go out (this indicates that after automatic discharge of the fire extinguishers the fire has been stopped). If the warning lamp keeps burning, the flight engineer should immediately depress the push button and switch on the **SECOND ACTUATION** fire extinguishers to completely stop the fire in the engine compartment.

Note. When one engine has caught fire the flight can be continued on the other engine as the fire is being fought.

6. If fire occurs in the gear box compartment, the CCH-2A fire warning system operates, the fan blades automatically close and air supply to the gear box compartment is stopped. The fan blades are turned by means of a hydraulic cylinder rod which is mechanically coupled to the fan blades.

The fluid is fed to the hydraulic cylinder by means of the 1A-163 solenoid-operated valve whose electrical circuit is connected to the circuit of the helicopter fire fighting system. The complete closing of the fan blades during automatic operation of the CCH-2A fire warning system takes 2-3 seconds, the minimum gap between the blades varying from 4 to 12mm. This gap is sufficient for preventing breakage of blades.

Notes: 1. In usual conditions (when there is no fire) the fan blades are turned through a required angle by means of the PH-45 switch which cuts off the MI-100M electric mechanism. The blades are turned through the maximum angle within 15 seconds.
2. In all cases the position of the fan blades is checked by the VMPH-I indicator located on the flight engineer's instrument board.
3. When the fan blades are fully open, the indicator pointer is against division II which corresponds to 110°.

7. After the CCH-2 automatic fire warning system has operated and the fire has been smothered the fan blades remain closed whereas the fire fighting valve of the valve unit remains open. To open the blades and close the fire fighting valve mounted in the valve unit, the flight engineer should set the B-45 switch of the fire fighting system first to OFF and then to ON positions.

8. If the fire has been smothered by discharge of the automatically controlled fire extinguishers but it breaks out in some other place it is necessary first to close the fire extinguisher valve of the compartment in which the fire took place before and then to engage the fire extinguishers of the **SECOND ACTUATION**. To achieve it, turn off and then turn on the B-45 switch of the fire fighting system and depress the push button **SECOND ACTUATION** to supply the fire-extinguishing compound to the new fire hotbed.

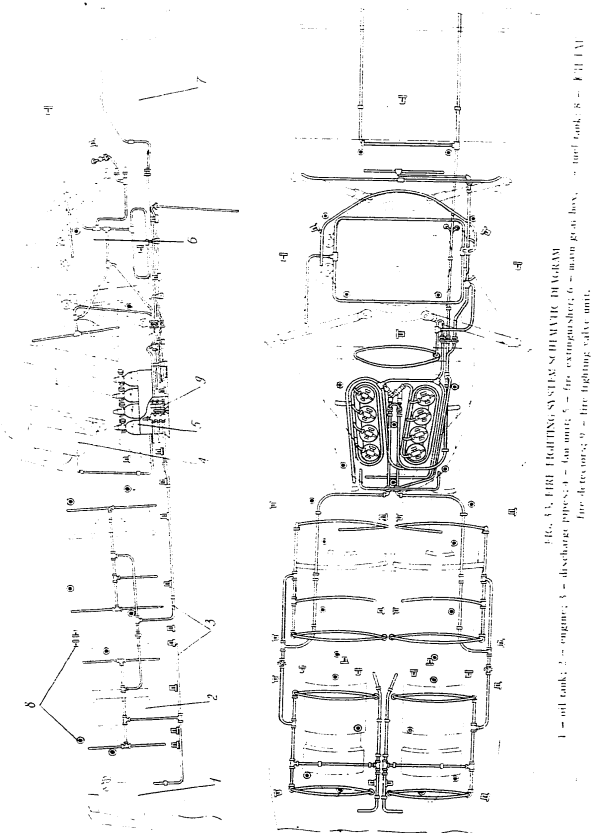
9. If however, fire breaks out in one of the compartments but the fire detectors fail to produce a fire warning signal it is necessary to depress the push but-

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ton of the respective compartment located on the flight engineer's control panel so as to open the fire fighting valve in the valve unit for supply of fire-extinguishing compound to the fire hotbed. This results in engagement of the automatically controlled fire extinguishers and then, if required, the flight engineer may switch on the manually controlled fire extinguishers by depression of the **SECOND ACTUATION** push button.

10. The OC-8M fire extinguishers discharged for stopping fire on the helicopter should be recharged with fire-extinguishing compound "3.5" or replaced with newly charged fire extinguishers of the same type.

The charge of one 8-litre fire extinguisher filled with "3.5" fire-extinguishing compound weighs 6 kg.

Depending on the temperature, the pressure in the fire extinguisher (as indicated by the pressure gauge) should not be less than specified below:

t°C	-60	-50	-40	-30	-20	-10	0	+10	+20	+30	+40	+50	+60
P kg/sq cm	39	43	47	51	56	61	66	72	78	84	91	98	105

Note. Fire extinguishers should be charged in compliance with special instructions.

11. After charging the fire extinguisher bonnets should be fitted with explosive cartridges.

12. If pressure in a fire extinguisher drops by more than 10% (the check is performed by the pressure gauges fitted on each extinguisher), be sure to recharge it or replace with newly charged one.

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Chapter VIII

HELICOPTER OPERATION AND MAINTENANCE IN
TROPIC CLIMATE

The present Chapter deals with measures to be taken when operating the helicopter under tropical conditions noted for high ambient air temperature, high humidity and heavy rains.

These specific climatic conditions are likely to cause corrosion of metal parts and accessories, premature deterioration and cracking of rubber items, oxidation of switchgear contacts and helicopter instruments and equipment. The parts made of non-metal materials (such as durite hoses, collars, holders, etc.) operate in most severe conditions because they are subject to the effect of sun radiation, and high temperatures which may reach 60°C inside and outside the helicopter.

These specific conditions call for performance of the following operations:

1. During long-term parking periods protect the wheel tyres from direct sun rays.
2. At temperatures above 30°C attentively check to see that the inner pressure in the L.G. shock struts is within the prescribed limits as indicated in the graphs for protrusion of the shock-strut inner tubes (see Chapter III "Care of Landing Gear and Hydraulic System, Part II").
3. In the course of operation systematically inspect the helicopter paint coating and in case of its damage immediately repaint the defective surfaces.
4. Pay special attention to condition of the glass panels in the crew cabin and cargo compartment, as well as to condition of sealing tubes of doors, hatches and windows. Broken glasses and defective sealing tubes of doors and windows should be replaced with new ones.
5. In case of leakage through rubber seals employed in the helicopter systems tighten up the seals. If this measure proves ineffective, replace the rubber seal with new one.
6. To prevent corrosion on surfaces of the control wire ropes of the tail rotor, main rotor brake, stabilizer, and the stop cocks lubricate the wire ropes with HK-50 grease not less than every three months.
7. Systematically check plug connectors for proper tightening. Inadequate tightening of plug connectors results in penetration of moisture into them which causes closing of an electrical circuit as a result of electrolysis between the pins of plug connectors when a power supply source is cut in.
8. To protect the Pitot tubes and total-pressure and static-pressure piping from clogging it is necessary to put jackets on the Pitot tubes and reliably fasten

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then after inspection of special equipment. Before each flight, check the readings of the speed indicator.

9. Every 5 days perform the following operations:

- check the shock-absorbers, inverters, voltage regulators and radio equipment for proper attachment;
- check condition of switching devices of generators, inverters, wear of contact brushes and clean the contacts from corrosion;
- check cleanliness of contacts and condition of contact brushes of generators, inverters and electric motors;
- check condition of the electrical mains wire lugs, reliability of contact connections between the minus wires and the helicopter frame.

Pay special attention to reliability of contact between the ballast resistors and the helicopter frame.

Do not disturb paint coating on the spots of electrical contacts between electrical components and the helicopter frame. (25)

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Chapter IX

USE OF EXTERNAL CARGO SLING SYSTEM

I. ASSEMBLY OF EXTERNAL CARGO SLING SYSTEM

1. Mount the external cargo sling truss together with a swivel lock (B9301-00) on special fittings located in the helicopter cargo compartment and connect the electric and hydraulic systems to the swivel lock.
2. Connect the HVT-I portable control panel of the JHP-3 motor-driven winch to the plug connector of the junction box (PK) mounted on the port side of the helicopter cargo compartment.
3. Assemble the sling wire rope by connecting the wire rope of the end fitting to the hook or directly to the shackle of the spider consisting of 4 wire ropes for attachment of loads. Check snap fasteners of the main hook and the hooks of the spider.
4. Open the loading doors in the cargo compartment floor and install the guard rail truss and the lower roller above the hatch.
5. Release the thin wire rope of the JHP-3 winch by depressing the wire rope release push-button on the HVT-I portable control panel and simultaneously pulling the wire rope by hand. The wire rope should be released by switching on only one motor.
6. Pass the wire rope through the lower and upper rollers and the swivel lock and attach the grip to the end of the wire rope. See that the swivel lock turns without binding; it should turn readily by a hand effort.
7. Attach the grounding cable of the helicopter near the front left door of the cargo compartment and check reliability of electrical contact between the grounding cable and the helicopter frame.

Note. Selection of proper length and attachment of wire ropes are made depending on the weight of the load and in conformity with the graph of maximum allowable distances between opposite attachment points of the external cargo sling (B0305-00) during attachment of loads. (2)

II. CHECKING EXTERNAL CARGO SLING SYSTEM FOR PROPER FUNCTIONING

(to be performed before flight with load on external cargo sling)

1. Connect the hydraulic system ground power supply source to the PA-2IM/9 solenoid-operated valve installed on the 505301-375 panel. Set the toggle switch of the PA-2IM/9 solenoid-operated valve for feeding from the ground power supply source.

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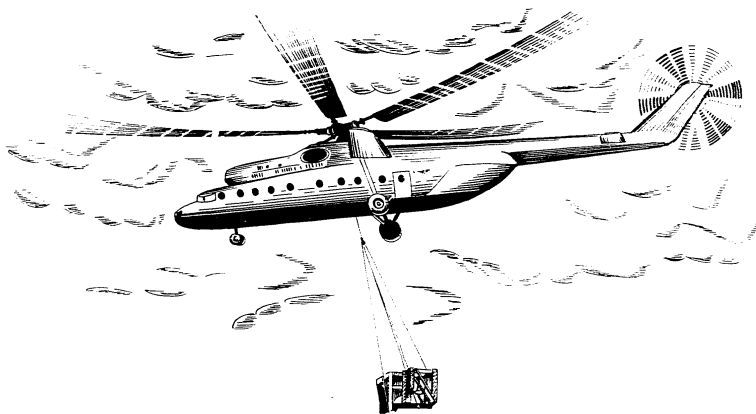


FIG. 34. Mi-6 HELICOPTER IN FLIGHT WITH LOAD ON EXTERNAL CARGO SLING SYSTEM.

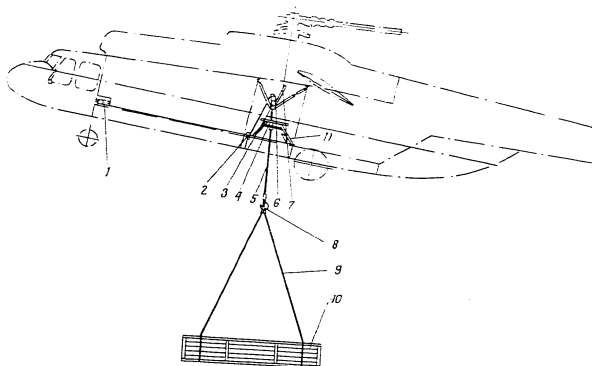


FIG. 35. EXTERNAL CARGO SLING SYSTEM

1 — winch; 2 — tension roller; 3 — swivel lock; 4 — grips; 5 — sling; 6 — hydraulic cylinder;
7 — brace; 8 — hook; 9 — load slings; 10 — load; 11 — guard rail.

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2. Open the swivel lock by the emergency load release knob.
3. Using the wire rope grip, engage the thin wire rope of the winch to the end fitting of the sling.
4. Make sure that the manually controlled valve of the hydraulic panel of the external cargo sling system is closed.
5. Using the ground power supply source of the hydraulic system, raise the pressure in the auxiliary hydraulic system to at least 40 kg/sq cm.
6. Switch on the JHP-3 winch for retraction of the sling. During retraction of the sling its end fitting enters the swivel lock and the latter gets closed. Closing of the swivel lock is indicated by flashing of the green pilot lamp located on the panel of the pilot's instrument board.
7. Make sure that the wire rope grip is disengaged from the sling end piece. To effect this, set the PA-2EM/9 valve toggle switch to OPEN position. As a result, the sling end fitting should fall out of the wire rope grip and the white pilot lamp located on the pilot's instrument board and on the FX junction box of the external cargo sling system should come on.
8. Check the load manual emergency release system employed in case of failure of the electro-hydraulic systems.
Perform the check as follows:
(a) bleed the pressure from the hydraulic cylinder of the swivel lock by setting the knob RELEASE (CIEPOC) of the hydraulic valve in the extreme lower position (the knob RELEASE is located on a special panel mounted directly on the truss near the swivel lock);
(b) open the swivel lock by turning the emergency release lever of the swivel lock downward;

Note. The swivel lock emergency opening lever is fixed in the end lug of the hydraulic lock arm and during operation of the hydraulic cylinder is kept from displacement by means of a special shock-absorbing cord;

(c) after release of the sling end fitting, turn the manual control knob in the extreme upper position to close the swivel lock.

CAUTIONS: 1. All operations on raising the sling by the JHP-3 winch should be carried out only with one motor of the winch running (to avoid breakage of the end fitting).

2. In all cases after raising the sling and closing the swivel lock (as indicated by flashing of the green pilot lamp) it is necessary to slacken the wire rope of the JHP-3 winch by turning the winch for the rope release for a short time. (19)

VIII. ATTACHING LOAD TO EXTERNAL CARGO SLING SYSTEM

(1) General

1. To ensure efficient attachment of loads to, and disengagement from, the external cargo sling of the helicopter, a flight supervisor should stay on the ground at a close distance from the load pick-up and landing site (50-80 m). The flight supervisor should help the pilot (by giving hand and flag signals) to approach the site for pick-up and landing of loads.

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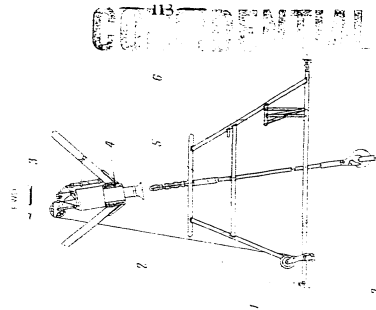


FIG. 13. A VERTICAL EXTERNAL SLING SYSTEM

1 - roller; 2 - handle; 3 - bracket; 4 - roller; 5 - cable; 6 - pulley; 7 - weight; 8 - switch; 9 - base.

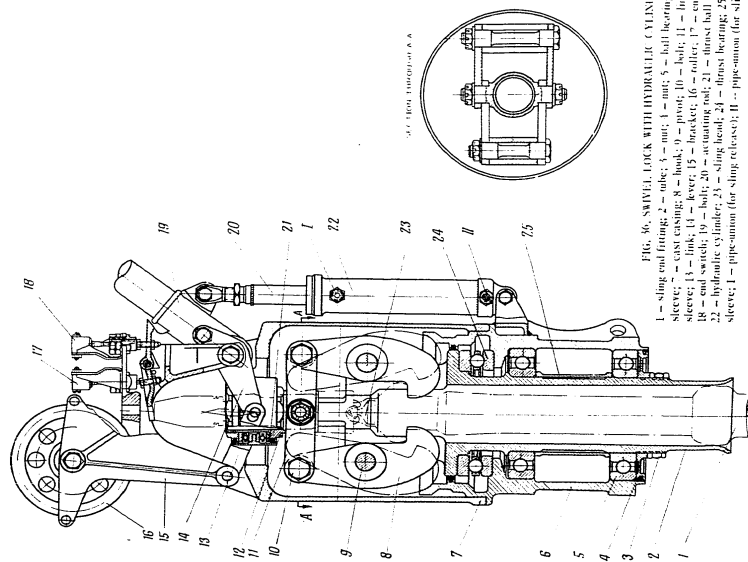


FIG. 16. SWIVEL LOCK WITH HYDRAULIC CYLINDER

1 - sleeve; 2 - nut; 3 - pin; 4 - link; 5 - bracket; 6 - roller; 7 - end switch; 8 - hydraulic cylinder; 9 - pipe union for sling locking.

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When conditions of terrain allow landing of the helicopter in the vicinity of the load.

1. The airfield personnel should take the fully assembled external cargo sling from the operator through the hatch of the loading compartment and attach it to the lifting points of the load by four snap fasteners of the wire rope spider or by one large main snap fastener of the wire rope spider or other rigging device have already been attached to the load.

(36)

2. Using the winch, the operator releases the thin wire rope together with the grip so that the length of the wire rope released through the hatch exceeds the distance from the helicopter to the load by 1-5 m.

3. The airfield personnel should take the JTD-4 winch with grip and attach it to the end fitting of the sling by means of the grip.

PROCEDURE FOR LIFTING THE LOAD
(When conditions of terrain allow landing of the helicopter in the vicinity of the load)

1. The airfield personnel should take the fully assembled external cargo sling from the operator through the hatch of the loading compartment and attach it to the lifting points of the load by four snap fasteners of the wire rope spider or by one large main snap fastener of the wire rope spider or other rigging device have already been attached to the load.

2. Using the winch, the operator releases the thin wire rope together with the grip so that the length of the wire rope released through the hatch exceeds the distance from the helicopter to the load by 1-5 m.

3. The airfield personnel should take the JTD-4 winch with grip and attach it to the end fitting of the sling by means of the grip.

4. The flight supervisor should occupy a place at a distance of 60-80 m from the helicopter within the field of vision of the pilot. After attachment of the winch rope, the flight supervisor should signal to the pilot that the approach of the helicopter to the load is possible.

5. After this the pilot should perform a vertical take-off to a height which is somewhat greater than the height of the load.

6. The pilot should smoothly move the helicopter sideways and make it hover above the load in conformity with the signals of the flight supervisor and instructions phoned by the operator to the pilot.

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On 11/11/77, the pilot saw the other pilot's instrument board and the
other pilot's left wing. At 1000 feet, at the pilot's request, the
other pilot released the parachute and parachuted to the rope release for an
ejection.

as indicated by cessation of the take-off) and at the ground to a height of not less than 100 feet of the helicopter in the

12. Using the radio altimeter during the hovering flight, the pilot should not fly below 100 ft and try not to fly below this altitude during the approach to landing.

1. To attach a load at hovering flight the pilot should make the helicopter hover at a small altitude in conformity with instructions of the flight supervisor located on the ground and the operator.
2. The operator should engage the fastener of his hold-on belt to the die-down ring attached to the floor of the cargo compartment and drop the sling and the grounding cable on the ground through the front door of the cargo compartment.
3. To avoid the effect of air flow produced by the helicopter upon the personnel busy with attachment of the load, the helicopter should be moved somewhat aside from the load so as to allow the airfield personnel to attach the sling to the load and to unfold the external cargo sling system.
4. After attachment of the sling the flight supervisor should give a command to the pilot to approach the load and hover near it.
5. The operator drops the grounding cable through the front door on the ground, occupies a place near the sling hatch and releases the wire rope of the АМН-3 winch together with the wire rope grip. After this the operator supports the wire rope by hands until the airfield personnel take it for engagement with the sling.
6. The airfield personnel should join then the wire rope grip to the sling end fitting and clear the helicopter.
7. On permission of the flight supervisor the pilot performs operations under Paras 7, 8, 9, and 10 of Section "A".
8. The operator places the grounding cable into the helicopter fuselage.

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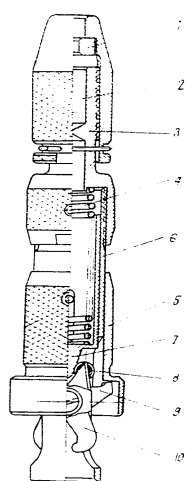


FIG. 8- GRIP FOR SLING ATTACHMENT

1 = cap; 2 = spring washer; 3 = nut; 4 = body; 5 = spring; 6 = coupling; 7 = grip; 8 = wedge; 9 = roller; 10 = grip jaws.

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IV. RELEASING LOAD

To ensure reliable functioning of the load release system the helicopter is provided with selector control of the swivel lock effected by hydro-electric valve with separate electric wiring.

The electric wiring of the normal load release system runs along the port side of the helicopter and that of the emergency load release system is laid along the starboard.

To perform a normal release of a load, it is necessary to depress the NORMAL RELEASE (ТАКТИЧЕСКИЙ СЕРОС) push button located on the control stick of the pilot.

In case of failure of the normal release system (damage to the valve or electric wiring) it is recommended to use the emergency release system. To achieve it, depress the EMERGENCY RELEASE (АВАРИЙНЫЙ СЕРОС) push button located on the collective pitch-throttle control lever of the pilot.

In case the electro-hydraulic system fails the load may be released by means of the manual emergency release system.

To effect this, proceed as follows:

(a) bleed the pressure from the hydraulic cylinder of the swivel lock by setting the RELEASE (СЕРОС) knob to the extreme low position (the RELEASE knob is located on a special panel mounted directly on the truss near the swivel lock);

(b) open the swivel lock by shifting the swivel lock emergency opening knob in the lower position without removal of the shock absorber.

V. SAFETY PRECAUTIONS TO BE OBSERVED BY MAINTENANCE
PERSONNEL OPERATING EXTERNAL CARGO SLING
SYSTEM

All maintenance personnel operating the external cargo sling system should observe the following safety rules:

1. When working in the cargo compartment near the exit door (dropping of the cargo sling and other jobs) or near the guard rail of the hatch, the operator should by all means use a hold-on belt.

2. The airfield personnel should not start operation on load attachment until a permission is given by the flight supervisor.

3. When joining the sling to the wire rope of the ЛНП-3 winch released from the helicopter the airfield personnel should remember that the work should not be started unless the grounding cable of the helicopter is dropped down and reliably grounded. (S)

4. Having joined the wire ropes and unfolded the cargo sling system the airfield personnel should immediately go away from the helicopter to a safe place so as not to suffer in case the pilot releases the load or the sling on emergency.

5. The personnel are not allowed to adjust the attachment hooks of the spider and the hook of the sling link when the helicopter is hovering over the load since it may cause gripping and injury of hands. (S)

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CHAPTER III
MAINTENANCE

PART I

LUBRICATION

The main and intermediate gear boxes of transmission are filled with special oil M9500-4/6 as indicated in Chapter III, Part I. In winter the oil should be filled as specified in Chapter VI, Part I of the Instructions.

The hinges of the tail shaft are also lubricated with special hypoid gear oil.

The oil should be injected into one of the holes located on the outer circumference of the shaft flange until the oil appears from the diametrically opposite hole.

The tail shaft is lubricated with M9500-4/6 syringe fitted with M9500-4/6 tip.

The pinion link shaft coupled to the driven shaft of the intermediate gear box should be lubricated with a syringe fitted with B9715-110 extension tip which is inserted through a special hole in the fan impeller and the diffuser (in this case it is necessary to unplug the diffuser).

4. The hinges of the fan drive cardan shaft are also lubricated with special oil M9500-4/6 (B9715-110-53).

5. The blades are lubricated by means of M9500-4/6 syringe fitted with M9500-4/6 tip. The syringe is inserted until it leaks through the safety valve screwed into the blade attachment.

6. The brake should not require any special care within its whole service life.

7. When working it is necessary to check adjustment of the brake shoes.

I. ADJUSTMENT OF MAIN ROTOR BRAKE

Adjust the adjusting screws of the brake shoes so that the clearance between the shoe and the drum is within 0.2-0.3 mm. Using a spacer screw of the brake shoe, adjust the clearance between the flat facets of the cam and the bearing of the shoe.

This clearance is checked by the size of the brake control lever play in the end of the support. The play should be within 0.5-3.5 mm at a 200 mm length of the lever (in the lever-to-brake control system wire rope attachment place), see drawing.

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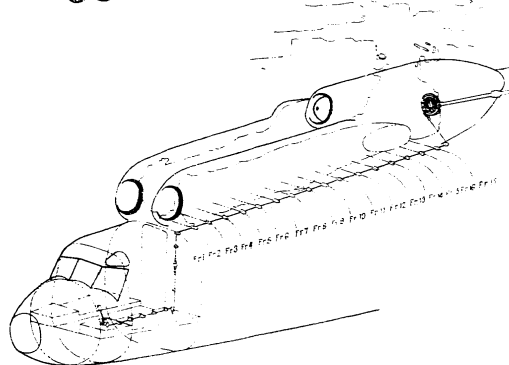


FIG. 39. LAY-OUT OF MAIN ROTOR BRAKE CONTROL SYSTEM.

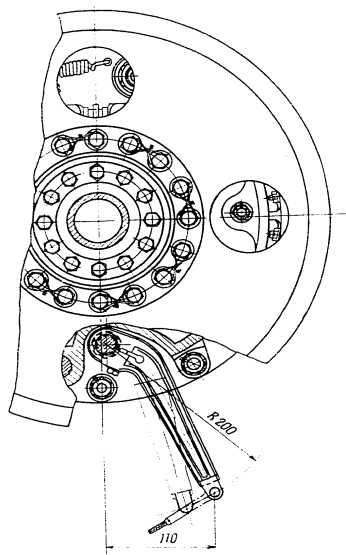


FIG. 40. MAIN ROTOR BRAKE CONTROL SYSTEM
DIAGRAM.

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Chapter II CARE OF MAIN ROTOR BLADES

1. Installation and removal of blades from the helicopter should be carried out by means of a hoist. The blade is engaged by the shackle installed on section No.8 (on section No.6 for blades illustrated in Dwg No.B2700-00). When doing this, support the blade at the end and keep it in a horizontal position so as to prevent damage to the skin in the location of the shackle.
 2. The blades removed from the helicopter should be stored in dry jackets indoors or outdoors (preferably under a shed). The plug connector is covered with plug (Dwg B2300-153a).
 3. The blades should be laid with the leading edges down in specially profiled supports. The supports are placed under sections 4, 11, and 17 (under sections 4 and 17 for blades illustrated in drawing No.B2700-00).
Temporary storage of blades on a transportation cart is allowed for 10 days maximum. Storage of blades directly on the ground is prohibited.
 4. The blades stored on the profiled supports outdoors should be aired at least once a month with jackets removed in the course of one bright day. The blade jackets should be dried at the same time. ☺
When stored indoors the blades should be aired with jackets removed for 2-3 days at least once in two months.
 5. Storage conditions should ensure reliable protection of blades skin from damage and direct contact with moisture.
 6. After removal of the blades from the helicopter for storage (over 30 days) it is necessary to coat the lugs and holes of the spar tip fitting as well as the butt surfaces of the spar root fittings with petrolatum or GLATOL-201 grease and wrap up the greased fittings with paper.
 7. The blades should be transported on a special cart (Dwg 6380/0180). They should be placed in profiled beds and fastened on the cart to special fittings.
 8. If the wind speed exceeds 20 m/sec, and the helicopter is not flown, the blades installed on the helicopter should be fastened through jackets, wire ropes and shackles to two special eye-lugs on the rear lower fittings attaching the brace struts of the landing gear to frame No.22. The tie-down wire ropes of two blades are attached to one eye-lug and the tie-down wire ropes of two other blades - to the other eye-lug; the wire rope of the fifth blade is attached to the eye bolt screwed into a special fitting on frame No.1.
- The blades (Dwg B2700-00) are fastened as follows: the tie-down wire ropes of two blades are attached to one of the eye-lugs on frame No.22, the wire rope of the third blade to the other eye-lug and the wire ropes of two other blades to eye bolts screwed into the special fittings on frame No.1. The tie-down wire ropes are connected to the blades by means of special shackles located in bays on section 8 of each blade.

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9. Jackets should be put on the helicopter blades in case the helicopter is to be withdrawn from flights for more than 5 days or in bad weather periods. (C)

In winter jackets should be put on every day to avoid formation of ice on blade skin.

When putting jackets on, or removing them from, the blades care should be taken not to damage the *flaps*. If rain water gets into jackets remove water and dry the wet jackets.

10. In case blades get covered with ice on the ground the ice should be removed with warm air supplied from an airfield heater. The air temperature at the outlet of the heater should not exceed 80°C.

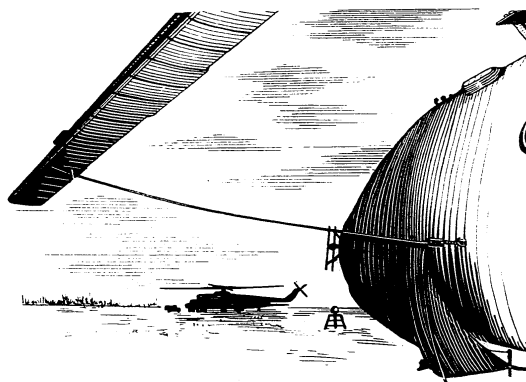


FIG. 41. BLADE TIE-DOWN SYSTEM.

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Chapter III

CHAPTER ON LANDING GEAR AND HYDRAULIC SYSTEM

I. LANDING GEAR

1. To ensure trouble-free operation of the helicopter take-off and landing equipment it is necessary to pay special attention to the pressure in the shock struts and tyres, to keep the landing gear clean and to perform maintenance operations and inspections in due time.

2. The pressure of nitrogen in the shock struts may be checked as follows:

(a) by means of a pressure-gauge. To effect this, lift the helicopter by jacks until the inner tubes of the main and nose shock struts are fully extended. Remove the cap from the charging pipe union of the shock strut under check and connect the appliance for charging the shock-struts with nitrogen;

(b) by extension of high-pressure chamber inner tubes and the inner tube of the nose shock strut, using special graphs and a pressure gauge for the purpose (Figs 42, 43). See that the inner tubes of the main L.G. left and the right shock strut high-pressure chambers extend to an equal length (the difference is allowed within 15 mm). If the difference in extension of the inner tubes exceeds the above limits, it is necessary to jack up the machine at the side where the inner tube extends to a smaller distance and equalize the extension values of the inner tubes from high-pressure chambers.

NOTE: The check of nitrogen pressure in the high-pressure chambers as instructed in item "b" should not be carried out if leakage of AMT-IO oil has been found in service. In this case the helicopter should be lifted by jacks and filled with AMT-IO oil to the required level.

If the check of nitrogen pressure shows any deviation from the prescribed limits, the pressure should be raised or relieved by means of the appliance indicated in Para.2. If the re-charging does not ensure the required extension of the inner tube as indicated in the graphs (Figs 42, 43), it is recommended to check the level of AMT-IO oil in the shock struts (see the paragraph below about charging and replenishing shock-struts).

(1) Replacement of AMT-IO Oil in Main L.G. Shock-Struts

1. Install hydraulic jacks under the lifting points of frame 22 and nose landing gear. Lift the helicopter so that the inner tubes of the main L.G. left and right shock strut high-pressure chambers extend by 210 mm (as measured on the polished surface of the inner tubes).

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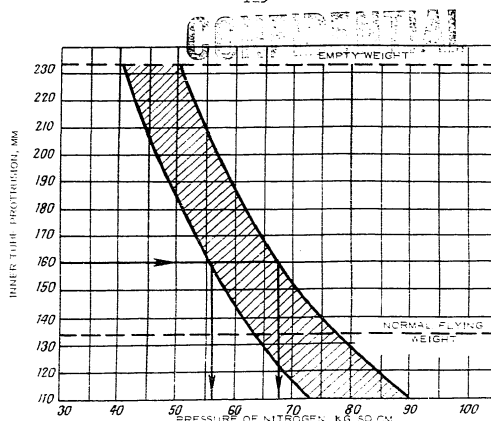


FIG. 42. GRAPH FOR CHECKING L.G. NOSE LEG SHOCK STRUT FOR PROPER CHARGING

Example: with the inner tube extended by 160 mm, the nitrogen pressure in the shock strut should be from 55.5 to 67.5 kg/sq cm.

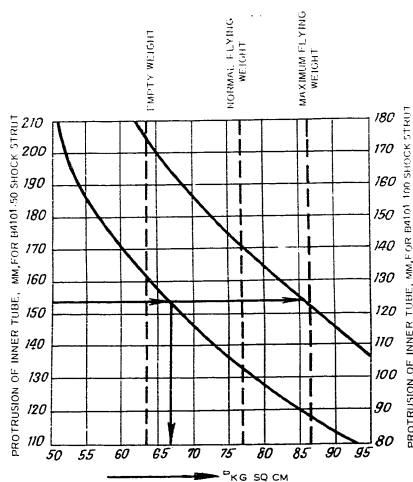


FIG. 43. GRAPH FOR CHECKING HIGH-PRESSURE CHAMBER OF MAIN L.G. SHOCK STRUT FOR PROPER CHARGING (31)

Example: with the inner tube protruding by 152 mm, the nitrogen pressure in the shock strut should be from 67.5 to 86.5 kg/sq cm for B4101-50 struts and from 57 to 72 kg/sq cm for B4101-100 struts.

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2. Using the shock strut charging appliance, bleed nitrogen pressure from the high-pressure chambers (as the nitrogen is being released the low-pressure chamber inner tubes start extending until they are fully extended and the inner tubes of the high-pressure chambers will travel through a respective distance) and screw off the charging pipe unions of the high-pressure chambers from both shock struts simultaneously.

3. Using the hydraulic jacks, lower the helicopter until the inner tubes of the right and left shock strut high-pressure chambers extend by 14^{+2}_{-3} mm (as measured by the polished surface of the tubes) and close the throttling valves.

4. Screw off the charging pipe unions and disconnect the hoses from the lower pipe unions of the high-pressure chambers. Drain off AMP-IO oil (when draining, protect the wheel tyre from AMP-IO oil).

5. Connect the hoses to the lower pipe unions of the high-pressure chambers, open the throttling valves and, using an oiling pot with a narrow spout, fill new AMP-IO oil in the high-pressure chambers through the charging pipe union holes until it reaches the level of these holes.

6. Screw in the charging pipe unions of the high-pressure chambers and screw off the plugs of the spring-type damper small pipe unions. Screw threaded end fittings of hoses into the small pipe union holes and place an empty can under the open ends of the hoses.

7. Raise the nitrogen pressure in the chambers to 0.5-1 kg/sq cm (if nitrogen is not available, it is allowed to use compressed air). After a solid bubble-free spray of AMP-IO oil starts flowing from the hoses screwed into the small pipe union holes, bleed off the nitrogen pressure from the high-pressure chambers, disconnect the draining hoses and screw the plugs into the small pipe unions of the spring-type damper. The quantity of AMP-IO oil to be drained through the small pipe unions should be not less than 3.5-4 litres. During elimination of air locks AMP-IO oil is changed in the spring-type damper and piping connected to the high-pressure chambers.

8. Make sure that the inner tubes of the high-pressure chambers extend through 14^{+2}_{-3} mm. Screw off the charging pipe unions of the high-pressure chambers and add AMP-IO oil until the oil level reaches the pipe union holes. Close the throttling valves.

9. Relieve the nitrogen pressure in the low-pressure chambers to zero and screw off the charging pipe unions.

10. Screw off the drain plugs and drain AMP-IO oil from the low-pressure chambers.

11. Using the hydraulic jacks, lower the helicopter so that the inner tubes of the low-pressure chambers extend by 15^{+2}_{-3} mm and screw in the drain plugs.

12. Fill AMP-IO oil in the low-pressure chambers of both shock struts until the oil level reaches the charging pipe union holes (the quantity of oil to be filled should be 5.1 litres).

13. Jack up the helicopter so that the inner tubes of the low- and high-pressure chambers are fully extended, screw in the charging pipe unions and charge the chambers with nitrogen as indicated below:

- the high-pressure chambers - to a pressure of 58^{+1}_{-1} kg/sq cm;
- the low-pressure chambers - to a pressure of 14^{+1}_{-1} kg/sq cm.

Note. In case of incomplete extension of the inner tubes it is allowed to create preliminary nitrogen pressure in the low-pressure chambers up to 1-5 kg/sq cm.

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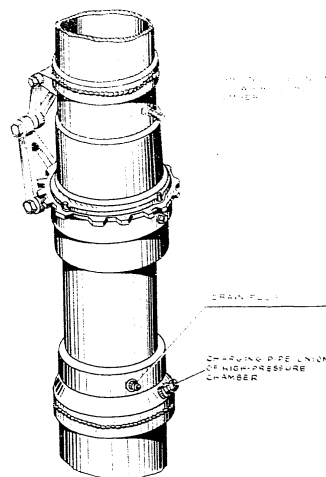


FIG. 16 SHOCK STRUT CHARGING AND DRAINING POINTS

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14. Open the throttling valves and keep them in this position for 10-12 minutes.
15. Close the throttling valves and bleed nitrogen pressure from the right and the left shock struts to 48 ± 1 kg/sq cm.
16. Open both throttling valves completely and seal them. Lock the pipe unions of the low- and high-pressure chambers, small pipe unions and drain plugs. Jack down the helicopter.

Notes:

1. The quantity of AMT-IO oil to be filled in each system "high-pressure shock strut - damper" should be approx. 21 litres, of which about 18 litres are filled in the high-pressure shock strut and about 3 litres in the damper and piping.
2. Change of AMT-IO oil in the damper occurs during charging of the high-pressure shock strut (see Paras 6-7).

(2) Replenishing Shock Struts of Main Landing Gear

A. High-Pressure Chambers

1. Install hydraulic jacks under the lifting points of frame 22 and lift the helicopter so that the inner tubes of the landing gear shock struts are fully extended and relieve the nitrogen pressure in the right and left shock struts to zero (see Para. 2, Section 1).
2. Screw the plugs from the small pipe unions of the dampers, connect draining hoses to them and raise the nitrogen pressure in chambers to 0.5-1 kg/sq cm. Check homogeneity of AMT-IO oil spray flowing from the draining hoses and make sure that it is free from air bubbles. When the oil spray becomes solid relieve the nitrogen pressure in the chambers to zero, remove the draining hoses and reinstall the plugs.
3. Using the hydraulic jacks, smoothly lower the helicopter so that the inner tubes of the high-pressure shock struts extend by $14 \pm \frac{2}{3}$ mm. With the shock struts kept in this position fill the chambers with AMT-IO oil until the oil level reaches the charging valve.
4. Lift the helicopter so that the inner tubes of the high-pressure chambers are fully extended, screw the charging pipe unions in these chambers, close the throttling valves of the damper and charge the chambers with nitrogen up to 58 ± 1 kg/sq cm pressure. Open the throttling valves of the damper and leave them in this position for 10-12 minutes. Close the throttling valves and bleed the pressure in the right and left shock struts to 48 ± 1 kg/sq cm. Open both throttling valves completely and seal them. Lock the pipe unions of the chambers and the small pipe unions of the damper.

B. Low-Pressure Chambers

1. Install the hydraulic jacks under the lifting points of frame 22 and lift and helicopter so that the inner tubes of the low-pressure chambers of both shock struts extend through $15 \pm \frac{2}{3}$ mm.
2. Bleed the pressure in the chambers to zero and remove the charging pipe unions of the chambers.
3. Check the level of AMT-IO oil and, if necessary, add oil until its level reaches the charging pipe union holes.

Note. It is allowed to add AMT-IO oil in each shock strut separately.

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4. Lift the helicopter so that the inner tubes of the low-pressure chambers are fully extended, screw in the charging pipe unions and charge the chambers with nitrogen to 14 ± 1 kg/sq cm pressure and lock the pipe unions.
5. Remove the hydraulic jacks.

(3) Charging Nose Shock Strut

1. Using the nose hydraulic jack, lift the nose portion of the helicopter so that the inner tube of the nose shock strut is fully extended and the wheels clear the ground.
2. Bleed the nitrogen pressure in the shock strut to zero (see Para.7, Section 1 of the present Chapter) and turn out the charging valve.
3. Drain AMP-IO oil from the nose shock strut through a special drain pipe union.
4. Smoothly lower the nose hydraulic jack so that the shock strut inner tube (as measured by the tube surface) is compressed by 390 mm and fill AMP-IO oil until its level reaches the charging valve hole. The shock strut should be filled with 6 litres of oil.
5. Using the nose hydraulic jack, lift the helicopter so that the inner tube of the nose shock strut is fully extended and the wheels clear the ground. Install a nitrogen charging appliance and charge the shock strut with nitrogen to a pressure of 27 ± 1.0 kg/sq cm.

(4) Charging of Tail Bumper Shock-Absorber

1. Remove the shock-absorber from the helicopter and using a nitrogen charging appliance, bleed the nitrogen pressure from the absorber to zero.
2. Screw the charging valve from the shock-absorber and drain off AMP-IO oil.
3. Compress the shock-absorber completely, place it vertically and fill with AMP-IO oil until the oil level reaches the charging valve hole. After this drain off 360 cu cm of AMP-IO oil (the quantity of oil to be left in the shock-absorber is about 2.2 lit).
4. Install the charging valve in place and using the nitrogen charging appliance, charge the tail bumper shock-absorber with nitrogen to 60 ± 1.0 kg/sq cm pressure.

(5) Care of Landing Gear WheelsCare of Pneumatic Tyres

To avoid entry of dirt and foreign objects into the pneumatic tyres, the latter should be installed and removed in a clean and dry place or at least on a piece of tarpaulin spread for the purpose.

Prior to installing the pneumatic tyres on the wheels inspect thoroughly the rims and the tyres proper. Grease, dirt and traces of corrosion should be removed from the rims. All the surfaces of the rims should be wiped dry with a cloth, especially in places where they are in touch with tyres and inner tubes.

The tyres should be inspected on the inside and outside, the inner tubes - only on the outside. Before assembling the tyres it is necessary to clean them from dirt and dust.

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Installation and removal of pneumatic tyres should be carried out at ambient air temperatures above zero. Never install frozen and hardened pneumatic tyres on the wheels. If there is no heated room it is recommended to warm the inner tubes before installation with hot air until they recover elasticity.

If some wrinkles are detected on the inner tubes which are in use, it is necessary to warm them until they become elastic and thoroughly inspect them.

The inner tubes free from cracks, excessively thinned or rubbed places are allowed for assembly and further use.

In case of sudden temperature changes it is necessary to take into account the pressure fluctuations in the pneumatic tyre. Therefore, during sudden changes of temperature the pressure in the tyre should be checked daily. If pressure drop is noted, the tyre should be re-inflated to the required pressure.

The pneumatic tyres should be inflated by means of a special appliance. The tyres of the main landing gear are inflated to a pressure of 5 kg/sq cm, those of the nose leg - to a pressure of 6 kg/sq cm. Deflection of pneumatic tyres at parking should not exceed the following limits:

Pneumatic tyres	All-up weight	Empty weight
Main L.G. struts	138 mm	100 mm
Nose L.G. strut	80 mm	58 mm

In service the tyres should be protected from oil, gasoline and sun rays.

Do not use tyres if they have the following defects:

(a) damage (separation of fabric) of the tyre at the flanges;

(b) ply separation at joints of the tread and the side-walls up to the cord

occurred with service:

(c) breakage of the tyre carcass;

(d) bulges in any spot of the tyre;

(e) mechanical damage: breakage, punctures, and cuts exposing the tyre carcass.

The inner tubes are not allowed for use if they have the following defects:

(a) cracks on the rubber of the inner tube (found when the rubber is stretched by hand) and local thinned spots;

(b) mechanical damage (punctures, chafed spots, etc.);

(c) leaks in spots of the valve attachment to the inner tube and through the slide valve.

II. HYDRAULIC SYSTEM

To ensure trouble-free operation of the hydraulic system it is necessary to perform all maintenance operations in due time and in conformity with the present Instructions and Certificates on separate units, to check the hydraulic unit and its accessories for cleanliness and leakage in connections. The instructions on operation of all components of the hydraulic system should be strictly followed.

When inspecting the hydraulic piping check the attachment of pipes in blocks and clamps. Do not allow the pipes to rub against other pipes or elements of the helicopter structure.

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Checking Hydraulic System for Operation

After replacement of the hydraulic system accessories and when the reliability of operation of the hydraulic system appears doubtful, it is necessary to check functioning of the hydraulic system.

The main, duplicating, and auxiliary hydraulic systems are checked for operation as follows:

(a) connect the airfield hydraulic unit to the helicopter main hydraulic system;
 (b) check functioning of the PA-74 solenoid-operated valve. With the valve out in and the controls manipulated, the readings of the pressure gauge should vary within 120 ± 5 - 155 ± 5 kg/sq cm. The controls should move smoothly and readily, without jerks or binding;

(c) check functioning of the duplicating system.

To this end, raise the pressure in the main system to 155 ± 5 kg/sq cm and switch off the valve of the main system. Connect the airfield hydraulic unit to the duplicating system;

(d) switch on the airfield hydraulic unit and open the valve of the duplicating system.

By manipulating the controls, make certain that during a pressure drop in the main system to 90 ± 5 kg/sq cm the green pilot lamp goes out, the red light panel comes on and the hydraulic boosters are switched over to be fed from the duplicating system;

(e) switch off the airfield hydraulic unit, remove the pressure nose from the duplicating system, connect it to the auxiliary system and switch on the airfield hydraulic unit;

(f) create the required working pressure in the auxiliary system and check operation of hydraulically driven units (opening and closing of the engine cowls, functioning of the collective pitch-throttle control lever, pilots' seats, system of glass wipers, opening and closing of loading doors, retraction of work platforms etc.).

Leakage Check

The hydraulic system is checked for leakage at the operating pressure. Switch on separate systems one after another (hydraulic boosters, work platforms, loading doors of the cargo compartment, wing control system, seats, swivel lock, glass wiper, collective pitch-throttle control and the special hatch access panel) and, maintaining the specified operating pressure in the system by means of the airfield hydraulic unit or a hand pump, make sure that there are no leaks in connections of pipes and accessories. Leakage of oil in connections of pipes and accessories is not allowed.

When the hydraulic system accessories are checked for functioning for 10 min under the operating pressure and at normal loading the oil is allowed to come out to the surfaces of movable connections in a finest film, without formation of drops.

When the hydraulic system accessories operate, the total quantity of oil squeezed through the external seal should not exceed 4 cu cm/hr in the course of the entire service life.

At parking the total quantity of AMP-IO oil squeezed through external seals should not exceed 2 cu cm/day.

REMEMBER! Never overtighten pipe connections since it may cause damage to thread and expanded portions of pipes.

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Other connections are tightened manually. Leakage of oil through them indicates that the mating parts of pipes are defective and should be replaced.

If oil leakage is detected in connections provided with taper thread, it is recommended to slightly tighten the elbow pipe (elbow or a cross-piece) but not more than by 1/4 of a turn or replace it with new one. Overtightening of connections may result in thread stripping, deformation of the elbow pipe or (which is more harmful) deformation of the unit body.

Inspection of Metal Pipes

When inspecting the hydraulic system pipes check the following:

- attachment of pipes with blocks and clamps. The pipes should not play in blocks and clamps. In case of play make sure that the pipes are not pressed due to pushing against their blocks or clamps and then reliably fasten the pipes.
- damage and fretting of pipes due to rubbing against other pipes or elements of the helicopter structure. The clearance between pipes and elements of the helicopter structure should be not less than 3 mm. During vibration inevitably occurring in operation the wire ropes should not touch the adjacent pipes. When installing removable access panels see that they do not touch the piping;
- damaged protective painting and corroded pipes.

In case of damage to protective painting (which does not affect the condition of the pipe proper) determine the cause of damage and re-paint the damaged surface. If a pipe is scratched, fretted, corroded or otherwise damaged, determine the cause of damage and replace the defective pipe.

Inspection of Hoses

When in service the hoses should be protected from oil, gasoline and effect of sun rays.

In the course of inspection see that there is no mechanical damage to hoses in their end fittings and make sure that they do not leak in end fittings and connections.

In case leakage is detected in connections of hoses with pipes and accessories, tighten up union nuts and lock the nuts down.

The defective hoses should be removed from the helicopter and replaced with new ones.

Charging Hydraulic Accumulators

Charging hydraulic accumulators with nitrogen should be carried out as follows:

1. Using the charging panel of the helicopter hydraulic accumulators supply compressed nitrogen until the panel pressure gauge reads 85^{+5} kg/sq cm (there should be no pressure in the hydraulic system).
2. Install a special appliance on the hydraulic accumulator of the auxiliary system and bleed the pressure to 30^{+5} kg/sq cm.
3. Using the appliance, check pressure in the hydraulic accumulators of the main and duplicating systems which should be 85^{+5} kg/sq cm.

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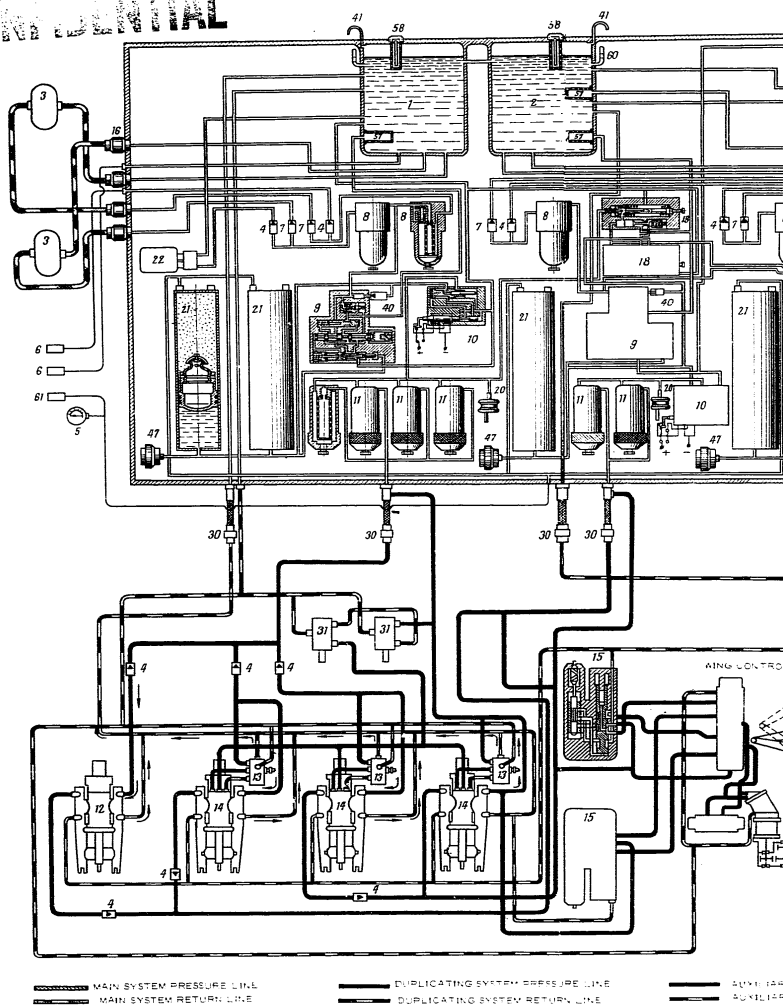
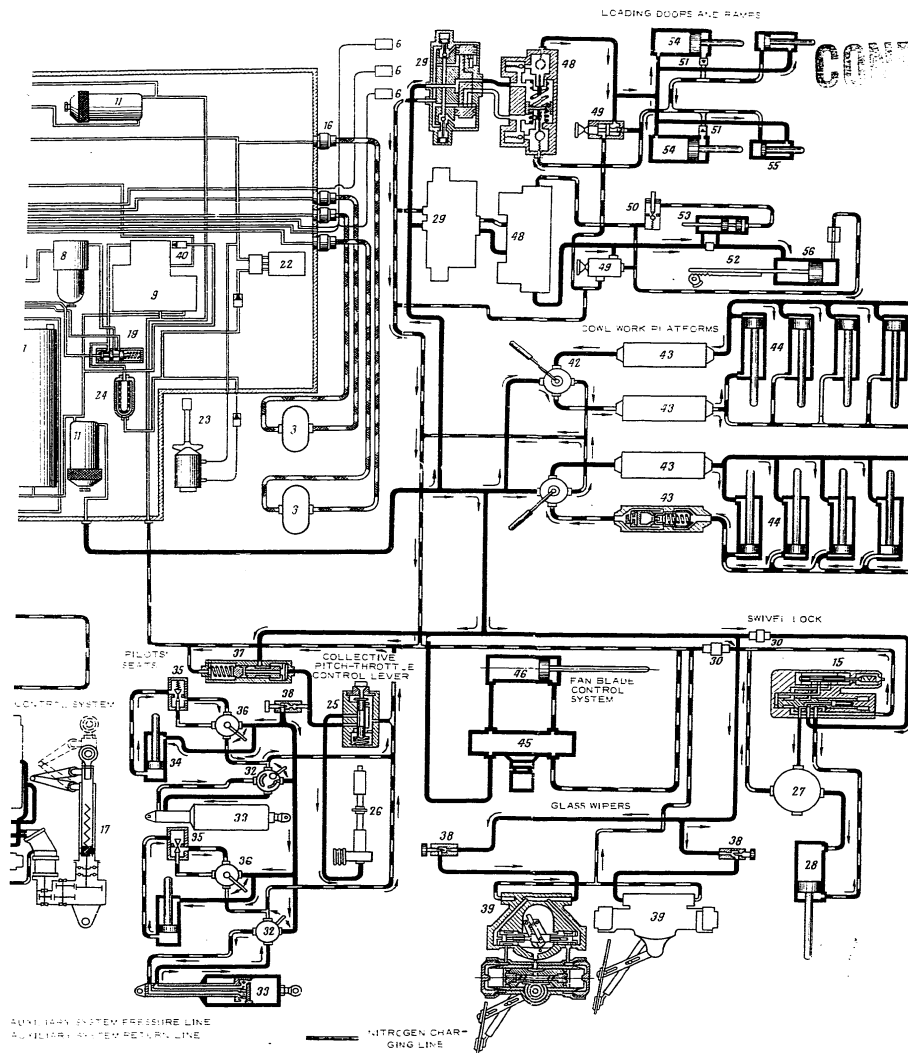
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FIG. 15. HELICOPTER

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OPER HYDRAULIC SYSTEM SCHEMATIC DIAGRAM

left-hand rotation gauge; 6 - charge; 7 - solenoid control unit; 8 - 200V pressure; 9 - coat; 10 - control; 11 - autopilot; 12 - engagement electric valve; 13 - pilot's seat tilting adjustment control; 14 - seat tilting adjustment cylinder; 15 - pilot's seat hoisting cylinder; 16 - seat cut-off valve; 17 - seat hoist control valve; 18 - 1 1/2" x 150.00.15 reducing valve; 19 - 1 1/2" x 230 throttle valve; 20 - 1 1/2" x 211 glass wiper; 21 - 1 1/2" x 16 non-return valve; 22 - reservoir vent pipe; 23 - cooling work platform hand control valve; 24 - 1 1/2" x 175 metering valve; 25 - cooling platform actuating cylinder; 26 - solenoid-operated hydraulic valve; 27 - 1 1/2" x 16; 28 - fan turn; 29 - blades actuating cylinder; 30 - 211V.120 pressure gauge electric transmitter; 31 - ramp two-way hydraulic lock; 32 - 1 1/2" x 150.00.15 reducing valve; 33 - 1 1/2" x 35 plunger valve; 34 - 1 1/2" x 150.00.15 reducing valve; 35 - 1 1/2" x 150.00.15 reducing valve; 36 - 1 1/2" x 150.00.15 reducing valve; 37 - 1 1/2" x 150.00.15 reducing valve; 38 - 1 1/2" x 150.00.15 reducing valve; 39 - 1 1/2" x 150.00.15 reducing valve; 40 - 1 1/2" x 150.00.15 reducing valve; 41 - 1 1/2" x 150.00.15 reducing valve; 42 - 1 1/2" x 150.00.15 reducing valve; 43 - 1 1/2" x 150.00.15 reducing valve; 44 - 1 1/2" x 150.00.15 reducing valve; 45 - 1 1/2" x 150.00.15 reducing valve; 46 - 1 1/2" x 150.00.15 reducing valve; 47 - 1 1/2" x 150.00.15 reducing valve; 48 - 1 1/2" x 150.00.15 reducing valve; 49 - 1 1/2" x 150.00.15 reducing valve; 50 - 1 1/2" x 150.00.15 reducing valve; 51 - 1 1/2" x 150.00.15 reducing valve; 52 - 1 1/2" x 150.00.15 reducing valve; 53 - 1 1/2" x 150.00.15 reducing valve; 54 - 1 1/2" x 150.00.15 reducing valve; 55 - 1 1/2" x 150.00.15 reducing valve; 56 - 1 1/2" x 150.00.15 reducing valve; 57 - 1 1/2" x 150.00.15 reducing valve; 58 - 1 1/2" x 150.00.15 reducing valve; 59 - 1 1/2" x 150.00.15 reducing valve; 60 - 1 1/2" x 150.00.15 reducing valve.

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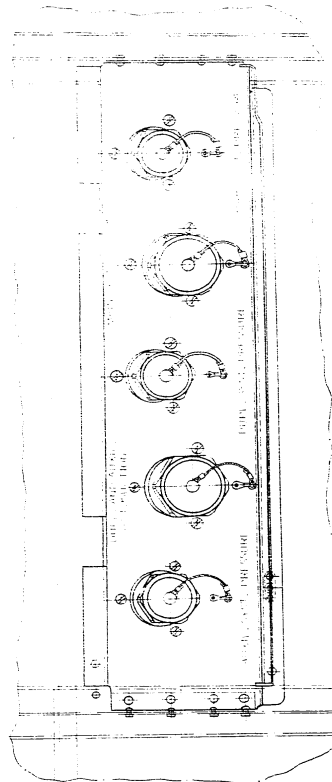


FIG. 6. PANEL FOR ACCESS TO CONTROL AND MONITORING OF HYDRAULIC SYSTEMS OF THE "S-400".

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Actuating Systems of Loading Doors,
Ramps, and Cows

1. To open the cargo compartment loading doors and ramps act as follows:
 - (a) start the electric pump or use a hand pump to build up pressure in the auxiliary system, in case there is no pressure in the hydraulic system;
 - (b) turn on the rear loading door control switch located on the flight engineer's panel.

Note. The loading doors and ramps may be actuated only when the pressure in the system is not below 75 kg/sq cm.

2. To open the loading doors and ramps in emergency:
 - (a) open the access panel on the auxiliary hydraulic system panel located in the cargo compartment;
 - (b) shift the hand-operated cocks all the way to the full open position to disconnect the PA-85 hydraulic lock and PA-185 valve;
 - (c) take a special wrench held by fixtures in the recess near the lock and open the lock on the doors;
 - (d) open the loading doors and ramps.
3. To open the cowl, build up pressure in the auxiliary hydraulic system and using a special wrench, open the cowl control valves located in the recesses under the engine air intakes.
4. To effect an emergency opening of the cowl, open the lock of the respective cowl (with the help of a screw driver) and open the cowl manually.
5. To close the loading doors and ramps after they have been actuated by emergency methods, first shift the PA-185 valve towards the open position (to build up pressure in the system) and then shift the valve towards the closed position.

WARNING: In case pressure in the auxiliary hydraulic system operated on the ground drops after electric pump 465M has been cut off, proceed as follows:

- (a) disconnect the pilots' seats adjustment line by closing the PA-230 valve;
- (b) boost pressure in the hydraulic accumulator until it reaches 60 kg/sq cm by starting electric pump 465M or using the hand pump; after this operate the auxiliary hydraulic system;
- (c) all the operations requiring employment of the auxiliary hydraulic system over, open the PA-230 valve.

Use of Electric Pump 465M

Electric pump 465M may be used to build up pressure in the main and auxiliary hydraulic systems in the following cases:

- (a) with the engines operating - if the compressor r.p.m. is not below 40%;
- (b) with the engines inoperative - from a ground power source, with the PA-74 valve open - for 15 min continuously, followed by a 15 min interval.

CAUTIONS: 1. To prevent discharge of the inboard storage batteries, never keep pump 465M connected to the helicopter electric mains for more than 1 min.

2. A build-up of pressure in the main system up to 100 kg/sq cm by means of pump 465M with the PA-74M valve de-energized must take not more than 1 min.

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CONFIDENTIALUse of Pump 465M for Checking HelicopterControl System

For checking the stick control system, foot control system, and the main rotor collective pitch control system with the engines inoperative and no ground hydraulic pressure source available use the 465M electric pump. To this end, manipulate the tumbler switch located on the central instrument panel in the pilots' cabin to energize the pump. Since the required pressure is 150 kg/sq cm, connect the pump to a ground power source, as the pump builds up this pressure within a period of 1.5-2 minutes and the helicopter storage batteries are allowed to operate in this case not in excess of 1 min.

The pressure in the system must be brought to the required level with the PA-74 valve of the main hydraulic system closed (the valve switch on the central instrument panel must be thrown to OFF as the pump operates).

Should the pressure drop down to 80 kg/sq cm before the check is over, raise the pressure to 150 kg/sq cm again by repeating the above procedure.

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Chapter IV

CARE OF FUSELAGE AND WING

To prolong the helicopter service life and to prevent premature wear due to corrosion, constant attention should be paid to condition of the surface coating on the fuselage and wings, to timely save it from mechanical and chemical damage.

To keep the helicopter paint coating undamaged in service, during storage or repair, never tread on helicopter surfaces (use mats to protect them), do not place metal articles, parts or tools on the skin; pad the ladder ends contacting the helicopter surfaces with rubber or soft fabric.

Keep the helicopter clean, for which purpose timely remove dust and dirt from the skin of the fuselage and wings, since these accumulate moisture and are detrimental to the anticorrosion coatings.

In summer regularly wash the entire surface of the helicopter with warm water (30-40°C) and then wipe it dry. Never use gasoline or kerosene for washing off dirt or dust, since this will destroy the paint coating.

After each flight remove from the skin all detected stains of oil, soot, dirt. Special attention should be paid to the skin areas exposed to exhaust gasses. For surface cleaning use warm water only, after which wipe the surfaces until dry.

In winter oil stains and soot should be removed with rags wetted in kerosene or gasoline. After this the surfaces must be immediately wiped dry.

When servicing the helicopter, take precautions not to stain the skin of the helicopter with electrolyte, oil or fuel. If, however, these substances get on the helicopter skin, wash them off immediately and wipe these areas dry, as recommended above.

In the course of scheduled inspections and preparations for summer (winter) operation the skin of the helicopter should be thoroughly examined. To this end, first remove the fuselage floorings and clean all the spaces from dust or dirt using compressed air or brushes.

All corrosion-attacked areas must be washed with warm water (in summer) and cleaned with emery powder No.220 (with the help of wetted cotton waste). Then these surfaces must be wiped with a piece of cloth soaked in gasoline and wiped dry. After this the surfaces should be prime-coated and painted.

In case deteriorated paint coating or corrosion-attacked surfaces are detected in winter, immediately remove corrosion products (by cleaning with emery powder), and coat the areas with neutral petrolatum.

When examining the skin, check all the rivet seams to detect all loose or deteriorated rivets and loose fitting of the skin sheets.

Loose rivets are detected by poor condition of paint coating around them.

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Defective rivets must be replaced with new ones whose diameter is enlarged by 0.5 mm.

To remove the defective rivet, drill it out from the side of its swage head. Install new rivets into old holes which should be first checked for out-of-roundness, damage, cracks, etc. If the hole is defective, enlarge it and install a rivet of a corresponding larger diameter.

I. ELIMINATION OF SKIN DEFECTS

Small-size defects on the helicopter skin (such as breaks, cracks, dents) are repaired by patching. Prior to applying a patch over a crack, stop-drill the latter.

Insignificant dents may be corrected by trueing them on a special-shape block with the help of a wooden mallet.

II. CARE OF SCREWS FURNISHED WITH SELF-LOCKING NUTS, OF BOLTS HOLDING L.G. AND GEAR BOX MOUNT UNITS

1. With service the screws of self-locking nuts of the cargo compartment upper flooring and of access panels in the helicopter skin may get loose. That is why it is necessary to regularly check them visually for tightness. If screws are found to project excessively over the skin, screw them down using a screw driver and make sure the neighbouring screws remain properly tightened.

2. Regularly check the bolts holding the L.G. attachment units at frames 1, 18, 22 and the gear box attachment units at frames 14, 18.

In case they are found loose, tighten them up and restore their locking. Coat the threaded portions of the bolts with grease LMATMM-201.

III. CARE OF DOORS EMERGENCY RELEASE MECHANISMS

1. In service regularly (every 100 hrs, but not less than once every six months) check operation of the door emergency release mechanisms.⁽¹⁰⁾

Subject to check-up are the mechanisms installed in the fuselage nose section:

- (a) on the navigator's door;
- (b) on the two doors of the pilots' cabin;
- (c) on the side door of the radio-operator and flight engineer cabin.

In the cargo compartment subject to this check-up are the mechanisms located as follows:

- (a) on the front entrance door;
 - (b) on the two rear doors.
2. If necessary, restore the red paint coat on the actuating handles.

3. After checking the emergency release mechanisms of the doors in the navigator, pilots, and flight engineer cabins, cock the mechanisms using the following procedure:

- (a) insert the nose ends of wrench B9502-3 between the stems and press together the wrench handles;
- (b) fix the springs by inserting lock pins into special holes;
- (c) release the wrench handles, remove the wrench from the space between the stems and insert the door handle instead;
- (d) remove the lock pins.

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4. Coat all the joints of the mechanisms with grease UMATM-201
5. All the checking operations over, seal the handles of the door emergency release mechanisms.

IV. CARE OF FUSELAGE GLAZING

1. In service maintain the helicopter glazing in proper condition. Wipe the windows of the cargo compartment and crew cabin with soft flannel or cotton wool soaked in alcohol or warm water and then wipe them dry with a dry clean piece of flannel.
2. Since cracks on the organic glass panels impair visibility, remove them by polishing with paste POW.

V. CARE OF DOORS AND THEIR LOCKS

1. Every 50 flying hours apply a coat of grease UMATM-201 to all the hinges and locks of the doors.
2. If the old coat of grease is found contaminated with dirt, wash the hinges and locks with dehydrated kerosene (with the doors in situ) prior to applying a fresh coat of lubricant.

VI. ADJUSTMENT OF AUTOMATIC GLASS HEATER IN PILOTS' AND NAVIGATOR'S CABINS

When preparing the helicopter for winter operation, or when the glass panels are excessively (or insufficiently) heated, adjust the AOC-81M automatic glass heater.

Carry out adjustment operations with the rotors stopped, in the following order:

1. Disconnect the wire from the temperature gauge (terminals 1 and 0). Use a tester to check continuity of the thermistor circuit.
2. Disconnect the wires from the control winding of the contactor (terminals A and B).
3. Connect the thermistor wires disconnected from terminals 1 and 0 to a resistor box (KMC-4, KMC-6, etc.) allowing to determine resistance up to 10,000 ohms, accurate within 10 ohms.
4. Connect the wires disconnected from terminals A and B of the contactor control winding to the voltmeter, and insert a pilot lamp of 27 V for each separate wire.
5. Set the resistance value to be attained on the resistor box.
The resistance adjustment value will be found in the Certificates for the helicopter glass heaters. Sometimes resistance of the thermistor at $t=20^{\circ}\text{C}$ is given, instead. In this case obtain the resistance adjustment value by multiplying the thermistor resistance value by 0.72 (coefficient).
6. Shift the slide of the AOC-81M heater adjusting resistor to the extreme right-hand position.
7. Throw in circuit breaker P-2 and switch BP-15 (see the circuit diagram) supplying power to the AOC-81M heater from 27 V mains of the helicopter. Here voltage will be registered by the voltmeter or the pilot lamp.
8. Gradually and slowly displace the slide counterclockwise until the voltmeter shows no voltage in the circuit or the pilot lamp becomes dead.

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9. Fix (lock) the slide in the position thus found.
10. Check adjustment results thus attained in the following way:
 - (a) increase the resistance of the resistor box up to 1000 ohms (this will be registered by the voltmeter or by the pilot lamp);
 - (b) in steps of 100 ohms decrease the resistance up to the moment the voltmeter shows no voltage in the circuit or the pilot lamp goes out.The values registered on the dial of the resistor box and by the voltmeter (or the pilot lamp) must not differ from that of the heater resistance by more than 1300 ohms.
In case this value is exceeded, re-adjust the AOC-SLM heater in question.
11. Disconnect the wires from the resistor box and connect them to the thermostat.
12. Disconnect the wires from the voltmeter (or the pilot lamp) and connect them to the control winding (terminals A and B) of the contactor.
13. Repeat the above adjustment and checking operations for all other heaters.
14. With the engines operating, at free turbine r.p.m. equalling 76-83%, connect the glass heating system and make sure the glass panels of the helicopter windows get warm (by placing the hand on the glass from the cabin inside). (S)

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Chapter V

HELICOPTER CONTROL SYSTEM ADJUSTMENT

Adjustment operations on the helicopter control system are performed as in laid down below.

I. MAIN ROTOR CONTROL SYSTEM ADJUSTMENT

The main rotor control system adjustment is performed with the helicopter hydraulic system operating from a ground hydraulic unit or from electric pump 465M used together with the AM-8 turbogenerator. (2)

(1) Collective Pitch Control Linkage Adjustment

1. Set the collective pitch-throttle control lever to the lowermost position.
2. Adjust the length of the control linkage so that the slide of the swash-plate stops 0.2-0.8 mm short of the bolt heads. The gap will be varied by changing the length of vertical control rod 37 (Fig.47).
3. Shift the collective pitch-throttle control lever to the uppermost position. A corresponding travel of the slide must equal 85 ± 1 mm. The maximum travel value will be limited by the upper stop on the collective pitch-throttle control lever.
4. Adjust the drive of the collective pitch transmitter to keep the readings of the indicator within the following values:

Position of collective pitch-throttle control lever	Gap between slide and bolt heads, mm	Indications of YMB-I indicator
Lowermost (at stop)	0.2 - 0.8	1°
Intermediate	47	8°
Uppermost	85 ± 2	$13^{\circ}30'$

Note. With the collective pitch-throttle control lever thrown down abruptly, the slide may eventually touch the bolt heads.

5. Collective pitch readings shall be brought to the specified limits by rotating the turnbuckle and by changing the length of the transmitter arm.

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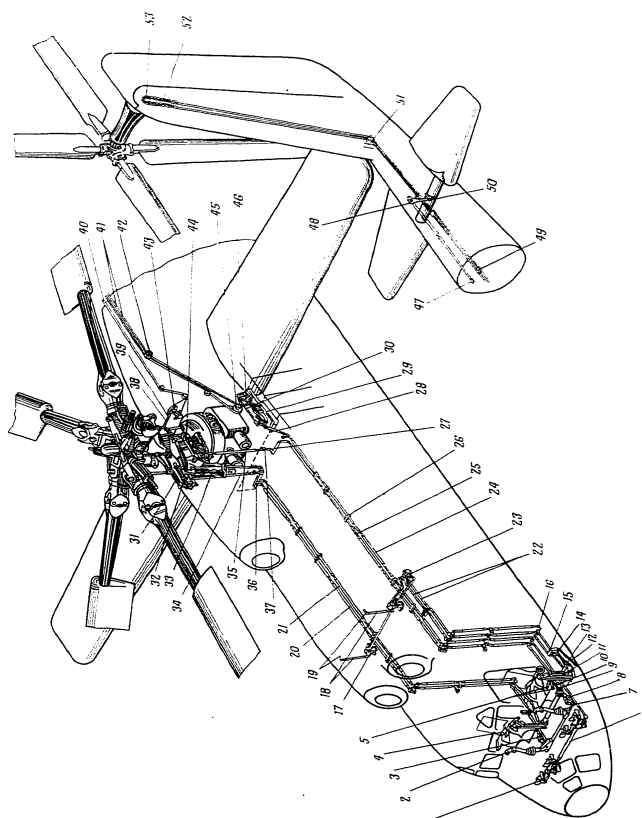
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FIG. 47. HELICOPTER CONTROL SYSTEM DIAGRAM

1 - foot control pedals; 2 - control stick; 3 - longitudinal control spring feel mechanism; 4 - collective pitch throttle control lever; 5 - engine selector controls; 6 - link; 7 - hinged link of lateral control; 8 - 90-180° electric mechanism; 9 - lateral control spring feel mechanism; 10 - foot control spring feel mechanism; 11 - collective pitch control rod; 12, 13, 14 - engine controls-to-engine rods; 15 - differential unit; 16 - bell cranks with adjustable stops; 17 - engine control bell crank; 18 - engine control rods; 19 - engine control levers; 20 - longitudinal control rods line; 21 - collective pitch control rods line; 22 - engine control bell crank assembly; 23 - engine control bell crank assembly; 24 - lateral control rods line; 25 - lateral control rods line; 26 - bell crank; 27 - bell crank; 28, 31, 35, 37 - rods with spring devices; 29 - hydraulic booster of foot control system; 30 - rod; 31 - rod; 32 - longitudinal control hydraulic booster; 33 - collective pitch control hydraulic booster; 34 - bell cranks; 36 - assembly for joining sublink to sublink; 37 - bell crank; 38 - bell crank; 39 - bell crank; 40 - bell crank; 41 - bell crank; 42 - bell crank; 43 - bell crank; 44 - bell crank; 45 - bell crank; 46 - worn gear mechanism; 47 - 40° sector; 48 - bush roller chain; 49 - pulley; 50 - pulley; 51 - sprocket; 52 - bush roller chain; 53 - collective pitch hydraulic booster control rod.

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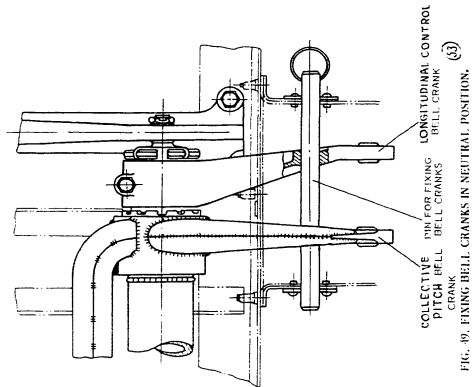
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FIG. 19. FIXING BELL CRANKS IN NEUTRAL POSITION.

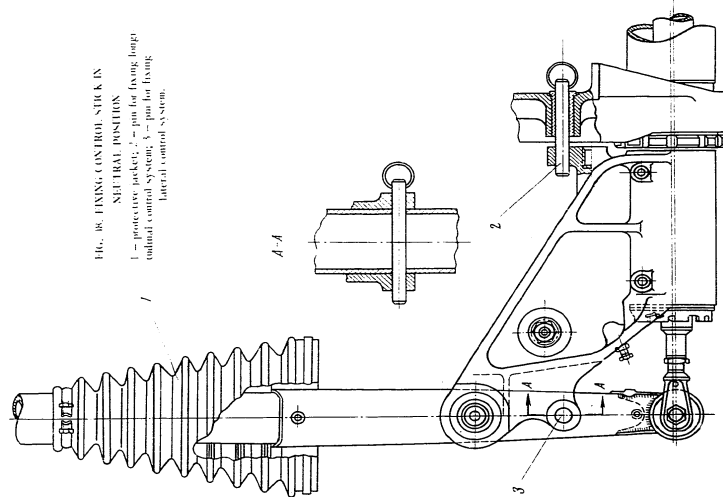


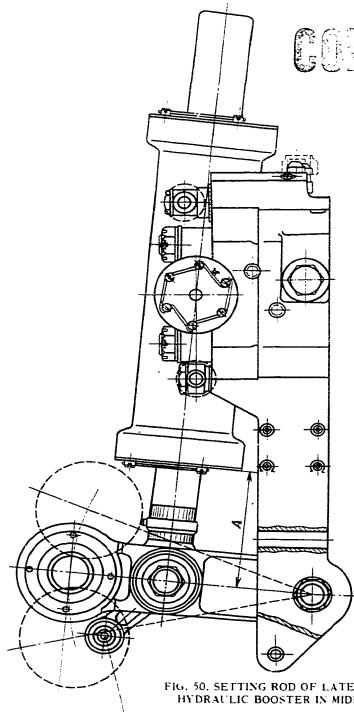
FIG. 18. FIXING CONTROL STRIKER IN
NEUTRAL POSITION.
1 - protective package; 2 - pin for fixing longitudinal control system; 3 - pin for fixing lateral control system.

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FIG. 50. SETTING ROD OF LATERAL CONTROL
HYDRAULIC BOOSTER IN MIDDLE POSITION.

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CONFIDENTIAL(2) Longitudinal and Lateral ControlLinkage Adjustment

1. Using special locking fixtures (Figs 48, 49), fix the control stick and bell cranks at frame 14 in the neutral position.
2. With the control stick at its equilibrium, the extension of the lateral control booster rod must equal $A=135 \pm 1$ mm, that of the longitudinal control booster rod must be $A=118.5 \pm 1$.

Size A is the distance from the booster cylinder end face to the rod fork bolt axis (Fig.50).

3. With the help of adjustable control rods connecting the booster rod with the swashplate bell cranks, adjust the position of the swashplate ring which should tilt $20^{\circ}18' \pm 6'$ forward and $1^{\circ}36' \pm 6'$ to the left as checked against the level and the vernier coupling sleeve. These values correspond to the neutral position of the control stick. The slide of the swashplate must be here 52.5 mm short of the lowermost position (Fig.51).

4. Disconnect the rods of the M1-100M spring-feel mechanisms from the lateral and longitudinal control system linkage and place the rods of the spring feel-mechanisms in the intermediate position - midway of their full travel (the YHY indicator will register zero position). Connect the rods of the mechanisms to the control linkage holding the control stick in the neutral position (with the help of the retainers). Do not apply efforts to connect the control linkage, otherwise the tension of the springs will be changed. If necessary, the spring-feel mechanism length will be changed by adjusting the end-piece.

5. Remove the locking fixtures from the control stick and bell cranks (at frame 14).

6. Adjust the stops of the control stick so as to ensure a proper tilting of the swashplate.

With the control stick in extreme positions, the swashplate should tilt as follows (by the pointer on the bell cranks):

forward	$7^{\circ}18' \pm 12'$
backward	$5^{\circ}36' \pm 12'$
to the right	$3^{\circ}54' \pm 12'$
to the left	$5^{\circ}24' \pm 12'$

The travel of the control stick here must be:
 $+170 \pm 10$; -180 ± 10 mm to effect the longitudinal control;
 $\pm 150 \pm 10$ mm to effect the lateral control.

CAUTION. In case replacement of units incorporated in the main rotor control system, or of the P-7 main gear box, or boosters, or swashplate is necessitated, do not fail to lock the control system (see Fig.48) prior to removing the units.

(3) Preliminary Setting of FeatheringHinges

To preclude objectionable vibration in the process of main rotor adjustment with the helicopter engines operating, the feathering hinges must be preliminarily placed in a position most favourable for operation of the control system. This is done in the following order:

1. Shift the collective pitch-throttle control lever until it occupies the lowermost position.

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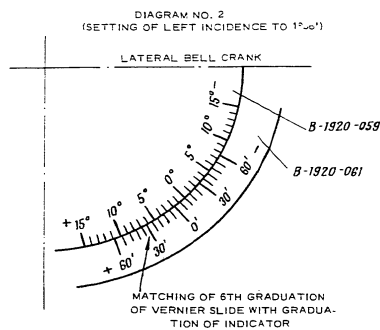
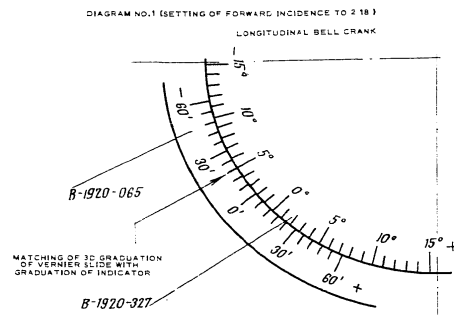


FIG. 51. ADJUSTMENT OF SWASHPLATE BY DIALS.

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1. Measure the length of the swashplate vertical push-pull rods to make sure it is within 340-345 mm (between the end-pieces) for all the blades (or within 340-345 mm for the blades manufactured in accordance with Dwg No.B2800-00).

2. Loosen the bracing bolts of the link-rod adjustable end pieces and adjust the length of the rods so that the measurements show one and the same value. The adjustment over, check operation of the controls.

Note. The feathering hinges are set in position finally only during main rotor blades tracking and adjustments of the coordinated collective pitch-throttle control system.

Throughout the procedure of adjusting the blade setting angle with the help of the scale and vernier of the hub, the blade must positively bear upon the rest of the droop angle limiter pawl. Besides, the blade must be displaced forward as to the direction of the main rotor rotation to be arrested by the stop of the drag hinge.

II. STABILIZER CONTROL SYSTEM ADJUSTMENT

1. Check whether the control wire ropes incorporated in the stabilizer control system linkage are properly tightened. The values to be observed in wire rope tightening are greatly influenced by the ambient air temperatures; therefore they are to be found each time in the charts given in Fig.52.

2. Place the helicopter in a position fully imitating its level flight attitude.

3. Install a special fixture (Dwg No.50-9715-140) to hold the protractor on the stabilizer.

4. Adjust the stabilizer control linkage to ensure the stabilizer downward deflection of minus $12^{\circ}30' \pm 30'$ (or minus $14^{\circ}30' \pm 30'$ for blades, Dwg No.B2700-00) from the tail boom axis with the collective pitch-throttle control lever in the lowermost position.

5. With the collective pitch-throttle control lever in the uppermost position the stabilizer deflection angle must constitute plus $6^{\circ}30' \pm 30'$ (plus $4^{\circ}18' \pm 30'$) upward from the tail boom axis.

Notes: 1. Bear in mind that the control wire rope tightening value is quite different for positive and negative ambient air temperatures. It is, therefore, required to re-adjust the stabilizer control system wire ropes each time before the beginning of a hot (or cold) season.
2. The stabilizer position will be adjusted by changing the length of the vertical control rod installed between the worm gear mechanism and the stabilizer assembly.

III. TAIL ROTOR CONTROL SYSTEM ADJUSTMENT

1. Using the locking fixtures (Fig.53), lock in position the foot control pedals and the bell crank attached to fuselage frame 14.

2. Shift the booster rod until it extends to $A=127.5 \pm 1$ mm.

3. Remove the locking fixtures.

4. Check whether the lever of the reduction gear unit, control wire ropes on the drum and the rod of the tail gear box, with the booster rod in the mid-travel (intermediate) position ($A=127.5 \pm 1$ mm), occupy also the mid-travel positions. The mid-travel position of the reduction gear unit lever is registered by $\pm 45^{\circ}$ from the stops; the tail gear box rod mid-travel position is checked by measuring the rod extension which is 495 mm (Fig.54). The rod displaces from the mid-travel position

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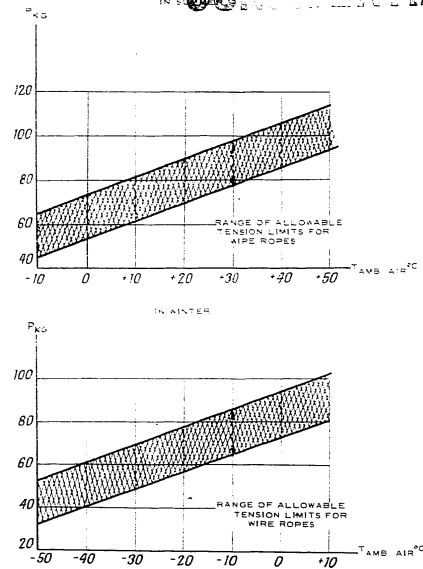
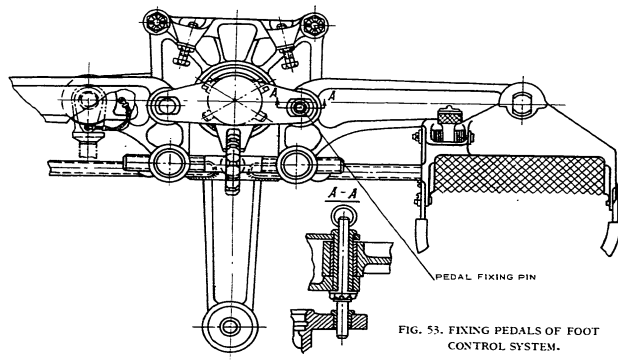
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FIG. 52. GRAPHS FOR DETERMINING TENSION OF STABILIZER CONTROL WIRE ROPES DEPENDING ON AMBIENT AIR TEMPERATURE.

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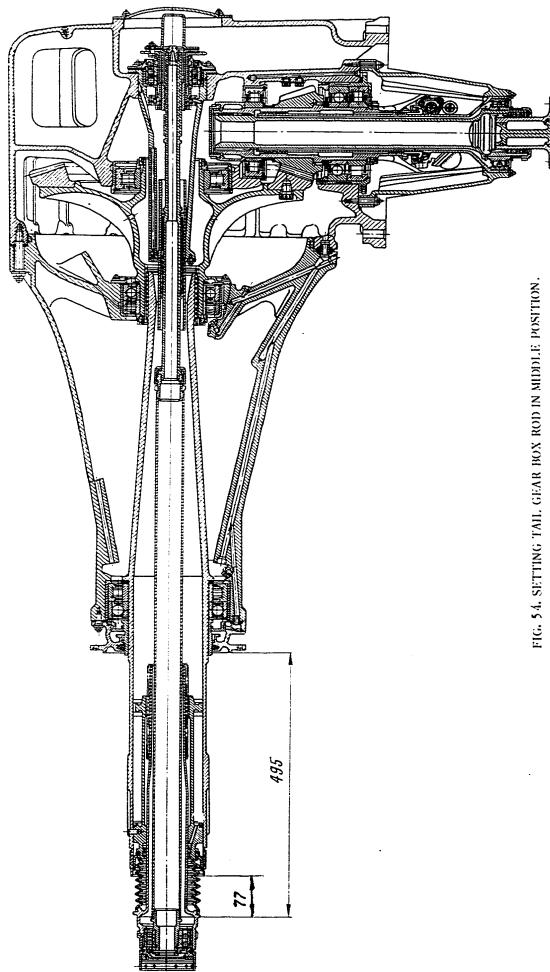


FIG. 54. SETTING TAIL GEAR BOX ROD IN MIDDLE POSITION.

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by $\pm 52.5 \pm 3$ mm when the control linkage is disconnected, at by a minimum, when the control linkage is disconnected. With the tail gear box rod in the mid-travel position, the setting angle of the tail rotor blades must equal $7^\circ \pm 15'$ as determined by the vernier and the indicating pointer.

Verify the tail rotor blade setting angles. With the control linkage properly adjusted, the angles must be:

- (a) $+4^\circ \pm 30'$ with the pedals in the neutral position;
- (b) $-9^\circ \pm 30'$ with the left pedal shifted all the way forward;
- (c) $+23^\circ \pm 30'$ with the right pedal displaced all the way forward.

5. If necessary, adjust the travel of the tail gear box rod in accordance with the values given above by using the turnbuckles in the control linkage or by displacing the chain over the sprocket. The chain may be displaced over the sprocket to form a difference of not over 15 mm in the length of the chain ends (at the neutral position of the system).

CAUTION: 1. In its extreme positions the rod of the tail gear box must stop at least 2 mm short of its stops, which is normally ensured by the travel of the rod (not exceeding 54 mm from the mid-travel position).

2. The tightening value for the control linkage as depending on the ambient air temperatures will be defined from the graphs given in Fig. 55.

3. It is forbidden to re-adjust in service the travel of the reduction gear unit quadrant by using the limiting screw bolts, since this may bring the quadrant out of mesh with the driven shaft teeth so far as to render the tail rotor uncontrollable in flight. In addition, the bolts, if screwed too deep into their sockets, may injure the reduction gear unit parts. The immediate result will be also a loss of tail rotor control. The movement of the entire control linkage must be limited by the stops on the pedals only.

IV. COLLECTIVE PITCH AND THROTTLE CONTROL SYSTEM ADJUSTMENT ^(S)

1. The collective pitch-throttle control system adjustment procedure must always follow the operations performed to adjust the collective pitch control system.

Prior to beginning the adjustment, make sure that:

- (a) with the collective pitch-throttle control lever in the lowermost position and its twist grip midway of its full turn the bell cranks at frame 1 are thrust against their upper stops; the angle of the HP-23 pump lever turn must equal $15-18^\circ$. Make sure the gap between the engine power control bell crank and the stop on nose section frame 8 is within 0.5-1 mm;
- (b) at the collective pitch within $8^\circ 30' - 9^\circ 30'$ (by the indicator) and full clockwise twist-grip, the bell cranks at frame 1 rest on their lower stops and the HP-23 pump levers reach (without any effort) their full power stops;
- (c) at the collective pitch of 8° (by the indicator) and full counterclockwise twist grip, the HP-23 pump dial shows $24-28^\circ$.

Note. With the collective pitch-throttle control lever gradually shifted downward from $\phi_{ind} = 5-6^\circ$, the twist grip will turn out clockwise from its extreme position in step with the movement of the engine power control bell crank towards its idling rating stop; at $\phi_{ind} = 1^\circ$ twist grip will occupy the midway position.

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the difference in the angle values indicated by the dials for the left and right engines within the range of 55° – 120° is not over 2° (to be finally verified during adjustment operations on a hot engine). Permissible difference for the range of 15° – 55° is up to 3° .

2. Start the engines and check their operation at idling rating with the collective pitch-throttle control lever in the lowermost position and the twist grip midway of its travel. The r.p.m. of the turbocompressor must be within the limits given in the Section "Engine Starting and Test-Running".

3. After the main rotor has been properly tracked, take all measurements characterizing operation of the collective pitch-throttle control system with the helicopter tethered. The values obtained must correspond to those tabulated below.

Indicated pitch, deg.	Counterclockwise twist grip		Clockwise twist grip	
	turbine speed, %	VHPT indicator or reading, deg.	turbine speed, %	VHPT indicator reading, deg.
1	—	15–18	78–82	30–36
5	—	—	84–87	40–58
8	—	24–28	84–87	84–92
9° – 10° – 30°	—	—	83–86	$96-100^{\circ}$

- Notes: 1. Check indications of the HP-23 pump dial using the VHPT-2 indicator with the twist grip turned counterclockwise and the main rotor collective pitch above 10° only when the engines are inoperative.
2. Continuous operation at free turbine speed of 87% normal value is permissible during a period not exceeding 5 min (when total running time amounts to 5% of the engine service life).
3. A short-time (not over 1 min) increase of free turbine speed up to 90% at engine power rating of not over 0.85 normal is permissible to check operation of the collective pitch-throttle control system on the ground.
4. A short-time (not over 3 min) decrease of rotor turbine speed down to 76% is permissible during the engine ground run with the aim of checking operation of the collective pitch-throttle control system, provided the engine power setting is not above 45° as checked by the VHPT-2 indicator and the collective pitch of the main rotor is set to the minimum value (9° – 10° by the VEB pitch indicator).

4. To take measurements as required by Point 3, it is permissible to change the amount of the collective pitch by changing the length of push-pull rods 1920–900.

Increase the length of the rods to decrease the r.p.m.; decrease the length of the rods to effect an increase in the r.p.m. One complete turn of the control rod will change the free turbine r.p.m. by 5–10%. Take care to introduce an equal length of change to all the rods, otherwise the blade tracking will be disturbed.

Note. Recommended lengths of the blade push-pull rods and values of the blade trim tab bending will be found in Section (5) "Main Rotor Blade Adjustment" of this Chapter.

5. A final check of the collective pitch-throttle control system is performed with the helicopter hovering at an altitude of up to 10 m at normal take-off weight. The free turbine speed in hovering must be within 78–86%.

x) This is take-off rating, a further increase of the pitch will result in a spontaneous movement of the twist grip counterclockwise.

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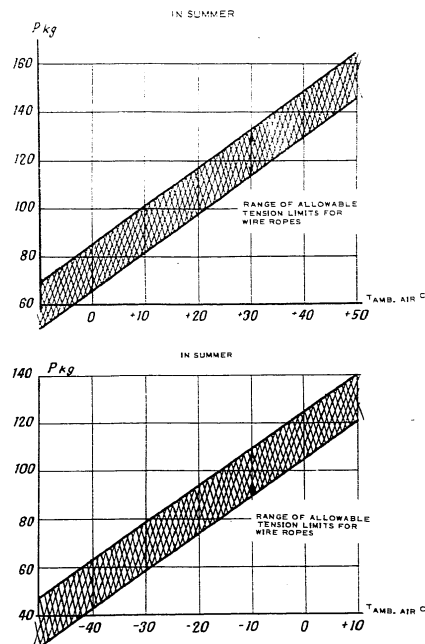


FIG.55. GRAPHS FOR DETERMINING TENSION OF FOOT CONTROL WIRE ROPES DEPENDING ON AMBIENT AIR TEMPERATURE.

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Indicated speed of free turbines in hovering at 5-10 m is 80-82%.

Note. A short-time (1 min) increase of free turbine speed up to 90% is permissible during a vertical take-off (at the moment of unsticking) or landing (at the moment of touch-down).

V. ADJUSTMENT OF COLLECTIVE PITCH-THROTTLE CONTROL
SYSTEM ON HELICOPTER FURNISHED WITH MAIN
ROTOR BLADES 2800-00 (52)

All check and adjustment operations pertaining to the collective pitch-throttle control system on the helicopter furnished with the main rotor blades manufactured acc. to Dwg No.2800-00 are performed in strict compliance with Section IV of the present Chapter provided the following is taken into consideration:

1. The recommended length of the blade push pull rods is 727-737 mm (310-325 mm between the end-pieces).

2. The measurements taken after the main rotor has been tracked must be as tabulated below:

Indicated pitch, deg.	Counterclockwise twist grip		Clockwise twist grip	
	turbine speed, %	VHPT indicator reading, deg.	turbine speed, %	VHPT indicator reading, deg.
1	-	15-18	76-80	32-36
5	-	-	84-86.5	60-68
8	-	24-28	84-86.5	84-92
9°±30'	-	-	85-86.5	96-100 ^{x)}

^{x)} This is take-off rating, a further increase of the pitch will result in a spontaneous counterclockwise movement of the twist-grip.

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Chapter VI

MAIN ROTOR BLADE TRACKINGI. HELICOPTERS FURNISHED WITH BLADES MANUFACTURED
ACC. TO DWG No.B2700-00

Blade tracking is performed with the main rotor set to rotation (on the ground and in flight) with the help of a special photographic camera.

The required amount of correction is determined by the relative position of the blade tip images on the film.

The blade tracking operations are performed in the order described below.

(1) Preparatory Operations

1. Install a marking strip on the tab of section 14 of blade No.1, and fix the strip with two bolts (Fig.56).

The strip belongs to the camera set used to track the rotor blades and is intended to mark the blade No.1 on the film. This mark is then used as the starting point to identify the other images on the film.

2. Install the camera attachment bracket on frames Nos 6 and 7 at the third glass blister on the starboard of the cargo compartment, using screws. Wipe the blister on the inside and outside using soft wiping cloth.

3. Screw the camera on the bracket, inserting the vertical attachment screw from below into the extreme right-hand hole of the bracket (Fig.57).

4. Plug the camera motor power cable into the receptacle of the extension lamp (27 V D.C.).

5. Direct the camera lens at the tip of the blade stopped at 45° to the helicopter longitudinal and lateral axes, forward and to the right in respect to the camera (Fig.58).

Holding the camera in this position, tighten the handle fixing the camera in the horizontal plane.

Notes: 1. The camera position in the vertical plane will be finally determined with the main rotor in motion (refer to Section (2), Para.3).
2. To focus the camera, loosen the locking nut and turn the focusing screw head (to displace the sleeve with the lens) until the reflection appears to be properly focused; then tighten the locking nut. (3)

6. Install the magazine loaded with a 10-15m roll of 100-mm oscillographic paper, having a speed of not below 700 units.

7. Select a diaphragm answering the peculiar conditions of the day:
4.5-6 for a sombre day;

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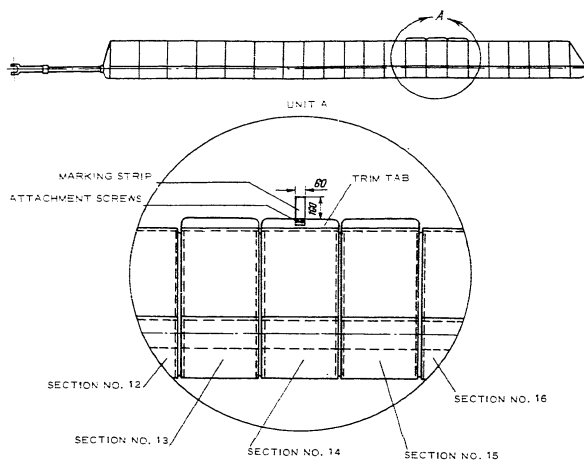


FIG. 56. POSITIONING MARKING STRIP ON BLADE No. 1.

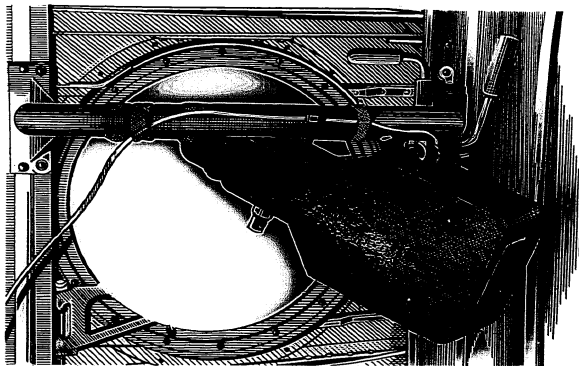


FIG. 57. CAMERA MOUNTED ON CARGO COMPARTMENT BRACKET.

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7-9 for a light cloudy day;
11-16 for a clear sunny day.

8. Press upon the starting button and let the camera shoot for a short period of time to test its operation.

(2) Ground Photographing of Blade Tips

1. In case a new set of blades is installed on the main rotor hub, the position of the feathering hinges is preliminarily adjusted by changing the length of the blade push-pull rods by a certain value (common for all the rods) within 305-325 mm; in other words, the distance between the lower end of the upper fork sleeve and the upper end of the lower fork nut (initial length value) must equal a value (320 mm, for example) valid for all the push-pull rods. The angle of blade tab bending must be 2° downward (relative to the bottom surface of the blade, Fig.59) for all the blades.

2. If a serviceable set of blades is installed, the initial values of the push-pull rod lengths and of angles of blade tab bending shall be found in the Certificate for this set of blades, containing all entries as to the adjustment of the blades on the helicopter they were removed from.

3. Start the engines; warm them up, and then apply a clockwise twist-grip to increase the engine r.p.m. to 78%. After this set the main rotor collective pitch to 5° and maintain the free turbine r.p.m. at 78% by using the twist grip. Aim the camera so that the blade tip track lies at $1/3$ from the upper edge of the view finder frame. Tighten the handle locking the camera in the vertical plane.

4. At the stable r.p.m. of the main rotor, on the command of the man who starts and runs the engines, depress the camera starting button for 5 or 6 sec to photograph the blade track.

CAUTION: 1. Accurate results in blade photographing on the ground are attained only in still weather or when a gentle wind (up to 4 m/sec) blows.

2. During the whole process of photographing the helicopter controls must be kept motionless.

3. For the blade tracking procedure on the ground, the helicopter must be either loaded up to its normal flight weight or tethered.

5. Shut down the engine. Remove the magazines with the film.

6. Develop and dry the film.

7. Examine the images and determine the amount of blade out-of-track. Remember that each millimetre of blade tip path displacement on the film corresponds to 45 mm of actual vertical displacement of the blades. The relative displacement (out-of-track) of the blades must not exceed 1.5 mm on the film (about 70 mm, actually).

8. In case the out-of-track value is found beyond the permissible limits, track the blades in the following way:

(a) determine the "base blade tip path" of one or several blades on the film and decrease the setting angle of the blades whose tip path lies higher than the "base tip path"; effect the decrease by shortening the length of the blade push-pull rods;

(b) increase the setting angle of the blades whose tip path lies lower than the "base tip path"; to this end, increase the length of the blade push-pull rods.

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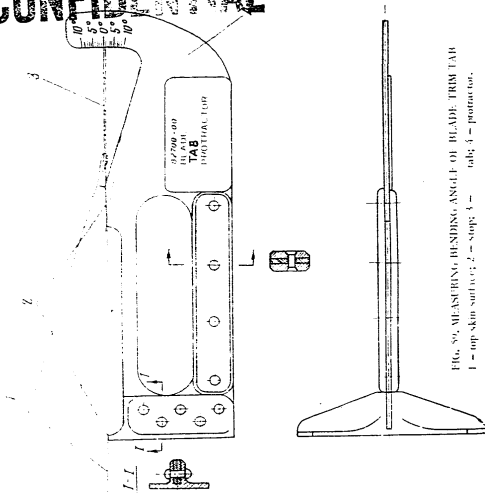


FIG. 56. MEASURING BENDING ANGLE OF BLADE TRIM TAB.
1 = top skin surface; 2 = stops; 3 = tabs; 4 = protrusion.

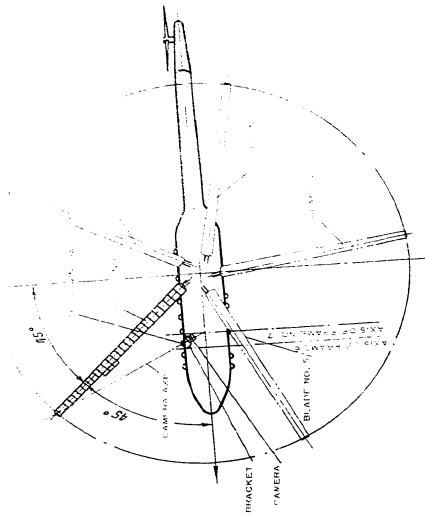


FIG. 58. BERTING-CAM IN HORIZONTAL PLANE.

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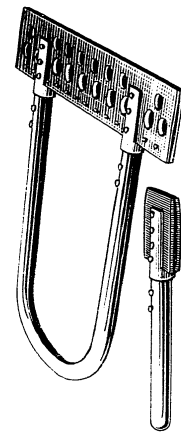


FIG. 59. APPLIANCE FOR BENDING AND STRAIGHTENING BLADE TABS.

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To displace the blade tip path on the film by 1 mm the actual vertical displacement of the blade, the push-pull rod must be turned 2 facets in or out.

Variations in the rod lengths are permissible within the following limits:

- (a) all the way in, to decrease the length;
- (b) till the threaded portion comes out of the upper fork sleeve to a distance of not over 60 mm, to increase the length of the rod.

9. Having ascertained the blades are properly tracked at 78% of the free turbine r.p.m., check the blades tracking at 83% of the free turbine r.p.m. and at a pre-set value of the main rotor pitch.

At 83% of the free turbine r.p.m. the images of the main rotor tips on the film may be found off from the "base tip path". In this case the blades located above the "base tip path" have a larger setting angle which is caused by the pitching moment. The pitching moment must be necessarily reduced by bending the blade tab downwards with the help of a special appliance (Fig.60). On the contrary, the setting angles of the blades located below the "base tip path" are decreased due to the twisting forces imposed by the pitching moment. The tabs of these blades must be slightly bent upwards. It should be remembered that one and the same bending value influences but slightly the position of the blade tip at 78% of free turbine r.p.m. and rather considerably at 83%.

The final aim of tracking operations is to bend the blade tabs accurately to such an extent as to bring the blades to the nearest parallel planes of rotation at any r.p.m. and, consequently, to bring to a minimum the differences in the heights of blade tip images on the films at 78% and at 83% of the free turbine r.p.m.

10. The ground tracking operations over, check and, if necessary, adjust the collective pitch-throttle control system to obtain the specified values.

11. A repeated photographing is not needed if no defects distinguishable to a naked eye and evidencing apparent mistakes in the adjustment are found during blade tracking operations performed in accordance with Step 9.

(3) In-Flight Photographing of Blade Tips

1. All blade tracking operations undertaken after ground photographing of the blade tips over, perform in-flight photographing of the blade tips.

2. For in-flight photographing establish level flight conditions at a height within 300-500 m, at 79% of the free turbine r.p.m. and indicated speeds equalling 150, 200, 250, and 300 km/hr.

Preference should be given to still weather, since bumpy air is likely to spoil the results as to make them unreliable in adjustment.

On a sunny day fly in a direction most favourable for photographing, i.e. from the sun.

3. When already level, check once again whether the camera is properly aimed (using the view finder) and, if necessary, correct the vertical position of the camera by fulfilling operations of Step 3 (Section (2)).

4. Under established flight conditions chosen in accordance with Step 2 above, start the camera for 2 sec, on the command of the pilot.

During the process of photographing deflections of helicopter controls are impermissible.

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(4) Analysis of Photographic Results

After the developed film is dried, proceed as follows:

1. Place the film with the images of the blade tips downward (blade roots, correspondingly, upward), with its first frames (beginning) to the right and with its last frames (end) to the left. This position is most convenient for analysis, since the vertical displacement of blade tip images corresponds, in direction, to the vertical displacement of the blades. In examining the images stick to the usual order - from *right to left* (Fig.61).

2. Scribe flight conditions (speeds) on the film and find the blade No.1 (by the marking strip). All other blades are numbered in the usual order - to the left from the blade No.1, i.e. 1, 2, 3, 4, 5, then again 1, 2, etc. (Fig.61).

3. Select a "base" blade, that is a blade (or a group of blades, sometimes) whose tip moves at some medium level (as compared to the path of other blade tips) during photographing on the ground or in flight at extreme conditions ($V=150$ km/hr and $V=300$ km/hr).

The "base blade" is selected so that the number of blades to be adjusted is reduced to a minimum and that the adjustment is as small as possible.

4. Connect the tips of the "base blade" with fine straight lines (with a sharp pencil) through every complete revolution. Determine the displacement (out-of-track) value of other blade tip images (accurate to 0.2 mm) relative to the drawn lines. The displacement values for each blade at the given flight speed are then averaged with due consideration given to the values most frequently coming across on different portions of the film.

5. Using the values obtained, plot a graph illustrating the deflection of the blade tips versus the flight speeds. Fig.62 is an example of such a graph, where blade No.2 is taken for a "base blade".

Run a curve for each blade through four points corresponding to the above flight speeds, to visualize variations of the deflection values as depending on the flight speeds.

Select a most effective variant of adjustment remembering that the number of blades to be adjusted must be minimal and that the correction values from the push-pull rod lengths and blade tab bending angles must be as small as possible (it has been adopted that the blades are adjusted to bring their tips nearer to the "base blade" path).

Referring to the curves run on the graph, determine the out-of-track values for the blade tips, in centimetres of the film at speeds of 150 and 300 km/hr.

6. In case the out-of-track value at speeds of 150 - 300 km/hr does not exceed ± 0.5 mm relative to the base blade tip path, adjustment operations are superfluous (blade No.2 in Fig.61).

If at a speed of 300 km/hr the out-of-track value increases by not more than 10-20% as compared to the out-of-track value at 150 km/hr, the blade is brought to the track by varying the length of the push-pull rod.

If at speeds of 150-300 km/hr the blades tend to run over the "base blade" tip path (leaving the position below the track at 150 km/hr and running to a position above the track at higher speeds, for example), bring the blade to a stable position relative to the "base blade" tip path by bending the blade tabs as is set forth in Section (2) "Ground Photographing of Blade Tips".

Usually a blade position is adjusted by changing the length of the push-pull rod and the tab bending angle.

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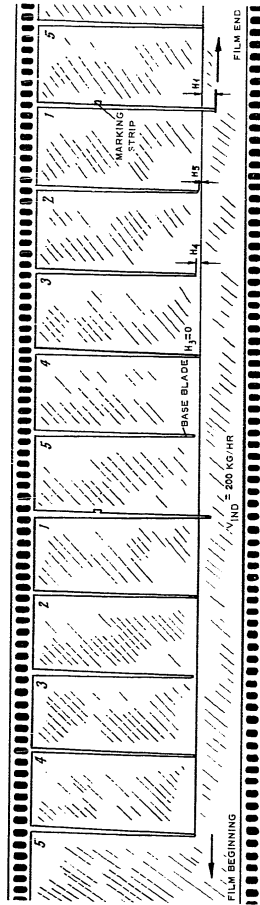
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FIG. 61. PIECE OF PROCESSED FILM.

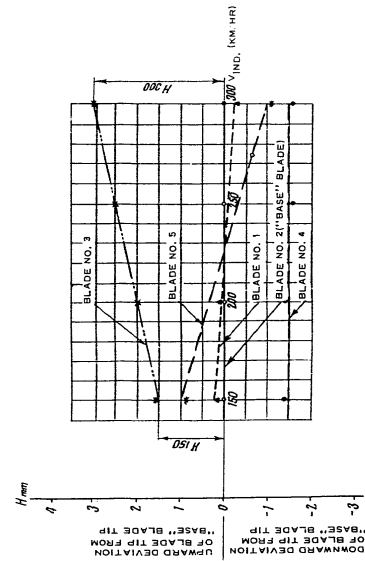


FIG. 62. GRAPH SHOWING DEFLECTION OF MAIN ROTOR BLADE TIPS AFTER FILM SHOOTING IN HORIZONTAL FLIGHT.

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(5) Main Rotor Blade Adjustment

The analyses over, perform adjustment operations on the blades.

To correct the length of the blade push-pull rods, turn the rods by the required number of facets. Bear in mind that:

1. One turn of the push-pull rod changes its length by 3 mm. Besides, the blade setting angle (pitch) changes by approximately $0^{\circ}27'$, and the blade tip displaces by 90-100 mm at flight speeds of 150 and 300 km/hr (about 2 mm on the film).

2. A correction of 0.5° to the blade tab bending angle displaces the blade tip by 20-25 mm at the flight speed of 150 km/hr and by 40-50 mm at the flight speed of 300 km/hr (or 0.5 and 1 mm on the film, respectively).

When tracking the main rotor blades, remember the following: ⁽⁹⁾

(a) the average tab bending angle for any separate blade ranges from 1° up to 5° down relative to the blade bottom surface (the average down angle for all the tabs of the main rotor blades is within $0-4^{\circ}$);

(b) a permissible value for the average (of three measurements) blade tab bending angle for separate blades is from 2° up to 6° down;

(c) lengths of turning rods as measured between the rod end-pieces must be within 305-325 mm (Fig.63).

Note. A slight increase in the length above the indicated limits is permissible, save the thread of the upper end-piece runs out to not over 60 mm.

To measure the blade tab bending angle, use a special protractor (Dwg No.9964-00), placing it with its two base points on the blade bottom surface skin.

The skin must be void of any surface deformations.

Measurements of blade tab bending angles are taken at each blade section carrying a tab (sections Nos 13, 14, 15). The protractor is successively installed at three points of each tab (at ends of the tab and in its middle).

The difference in tab bending angles for each blade (for the three tabs) must not exceed 1° , differences in measurements taken at three points of each tab must not be over 0.5° . If these values are exceeded, correct the angles by using a special bending appliance (Fig.60).

Always strive to attain highest accuracy in measurements and angle bending.

All measurements must be necessarily registered in a special log.

3. A test flight is performed after the blade tracking operations are over, to photograph the blades under the flight conditions established in accordance with Section 3.

If the film shows a considerable out-of-track in various flight conditions, carry out additional operations on tracking of the main rotor blades.

A blur of tip images of an adjusted rotor must not differ from that shown in Fig.64 (see also Section 2, Para.7) at flight speeds of 150-300 km/hr.

4. In case vibration does not reach objectionable values despite a visible tip blur on the film, further adjustment operations pertaining to blade tracking may be abandoned.

5. In certain cases additional adjustment operations may aggravate vibration imposed by the main rotor operation due to minor differences in blade weights, geometry and rigidity. Here a return to that stage of adjustment which gives best results in lessening helicopter vibrations is imperative.

The level of vibration may be determined either by the feel of the pilot (in service) or by use of special vibro-sensing (and recording) devices.

6. All final values attained in the process of blade tracking must be necessarily registered in the Service Log accompanying the set of the main rotor blades.

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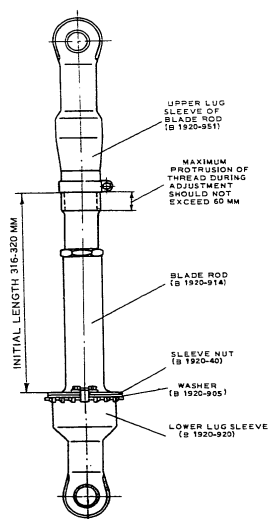


FIG.63. MAIN ROTOR BLADE TURNING ROD

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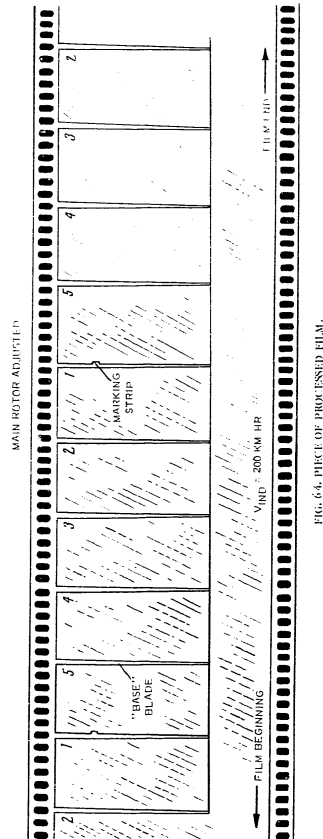


FIG. 64. PICTURE OF PROCESSED FILM.

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The number of the helicopter furnished with this set of blades must be also written down.

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7. The camera together with its bracket and the marking strip are removed from the helicopter after all the adjustment operations are completed.

Note. To protect the blade tabs against deformation and possible disturbance of their adjustment when protective covers are pulled over the blades, special tab covers (painted red) are supplied for the User to put them over the blade section tails before the blade protective cover is pulled over.

8. In case main rotor adjustment gets disturbed, first check the tab bending angles against those registered in the Service Log; if they prove to be different, correct them to attain the values registered.

II. BLADE TRACKING PROCEDURE FOR HELICOPTERS FURNISHED WITH MAIN ROTOR BLADES MANU- FACTURED ACC. TO DWG No.B2800-00

In case the helicopter main rotor carries blades manufactured in accordance with Dwg No.B2800-00, the blade tracking procedure as laid down in Section I must include the following additional steps:

1. The indicating strip shall be installed on section 16 of blade No.1.
2. Photographing in flight is performed at indicated speeds of 100, 150, 200 and 250 km/hr, the free turbine r.p.m. equalling 83%. These values should be taken into consideration during film analyses, accordingly.
3. In tracking the main rotor blades, bear in mind the following:
 - (a) a correction of 1° introduced into the tab bending angle will displace the blade tip by 20-25 mm at a flight speed of 100 km/hr and by 40-50 mm at a flight speed of 250 km/hr, these corresponding to displacement values of 0.5 and 1 mm, respectively, on the film;
 - (b) the tab bending angles must be measured at each section carrying a tab (sections 16, 17 and 18);
 - (c) the range of tab bending angle variations is from 5° up to 2° down. (S)

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Chapter VII

CORROSION-PREVENTIVE MEASURES AND STORAGE
OF HELICOPTERS

1. CORROSION-PREVENTIVE MEASURES (5)

Since helicopter structural components have surface protecting coatings (anodizing, prime-coat, zinc-plating and paint-coat), corrosion-preventive measures are mainly confined to maintaining their surfaces (or, rather, surface-protecting coatings) in proper condition. Extreme care should be exercised in service to protect the corrosion-preventive coatings on the helicopter structural component surfaces (such as anodized coating on duralumin parts, coatings on steel parts, and coatings of lacquer or paint) from all kind of damage (scratches, nicks, dents, and other) likely to expose the base metal.

It is essential after each flying day to remove all dust and dirt from helicopter surfaces, since accumulations of dust and dirt absorb moisture which is detrimental to coatings of lacquer and paint, thus provoking corrosion.

Note. Never use such substances as Vienna lime, sodium hydrate, soda, acid solutions, ammonia spirit etc. in removing oil stains and dirt from surfaces.

To preserve coatings protecting the metal surfaces against corrosion:

(a) never place tools, spare parts, gasoline (or kerosene) soaked rags, etc. on surfaces of helicopter cowls and structural elements;

(b) keep off fuel, oil, hydraulic fluid from helicopter surfaces not to stain them; if, nevertheless, these substances are occasionally spilled on surfaces during helicopter servicing, wipe them immediately dry.

Accumulations of dust inside the helicopter must be also removed regularly, otherwise dust accumulations absorbing moisture or leaking oil will form a crust yielding to solvents only.

Vacuum cleaners may be effectively used to clean the helicopter inside.

In all cases the protective coating is found damaged, immediately restore the coating over the injured portion (in summer) or coat it with a thin layer of petrolatum previously heated for the purpose (in winter).

Each time it stops raining, remove all covers from the helicopter, open all the doors and panels and leave the helicopter in this condition for several hours to air.

If, somehow, rough whitish spots of corrosion are detected on the helicopter surfaces, take immediate measures to remove it from the attacked surfaces.

To this end:

1. Remove the paint coating (in case the corrosion-attacked surface is paint-coated) using special solvent (or acetone, if solvent is not available);

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2. Clean off corrosion with emery cloth No.170 or No.230 wetted by aviation oil, and then polish the surface using paste POM.

3. Wipe the polished area with clean wipe-cloth soaked in gasoline E-70.

4. Paint the surface thus treated using a paint of a required colour. In winter, when the surface to be coated cannot be heated, apply a coat of petrolatum (instead of painting) to be removed as soon as weather becomes warm, with the help of cloth soaked in gasoline E-70. After the removal of petrolatum the surface must be painted.

5. To remove corrosion products from parts made of magnesium alloys and to restore the oxide film on the magnesium-alloy parts, follow the instructions set forth in the Section "Care of Magnesium-Alloy Parts" of this Chapter.

- Notes:
1. At subzero temperatures the oxide layer restoration is impossible; the corrosion-attacked spot on a magnesium-alloy part must be coated with a layer of gun grease after the products of corrosion are cleaned off.
 2. The gun grease layer is removed as soon as weather gets warm, with the help of gasoline E-70; the surface is then treated in accordance with the Section "Care of Magnesium-Alloy Parts".

II. ANTI-CORROSION TREATMENT

(1) Engine Processing

Processing the engine with corrosion-preventive substances is the basic measure undertaken to protect engine parts against corrosion during the time periods the engine is kept inoperative in the helicopter or stored at a depot, or is shipped. Anti-corrosion protection is attained by applying coats of corrosion-preventive substances to inner and outer surfaces of the engine parts and units.

Used as corrosion-preventive substances for processing inner surfaces of the engine fuel system (including all its accessories) as well as of the oil system of the engine turbo-compressor section is transformer oil (FOCT 982-56) or oil MK-8 (FOCT 6457-53).

Processing of outer surfaces of the engine and fuel system accessories is carried out with the help of dehydrated gun grease V3H (FOCT 3005) or neutral petrolatum (FOCT 782-47).

Depending on the terms of storage the engine is processed with corrosion-preventive substances either partially or completely.

Complete processing includes:

- (a) processing of oil system;
- (b) processing of fuel system; ⁽²⁴⁾
- (c) processing of engine outer surfaces.

If it is supposed to keep the engine in situ on the helicopter (without regular startings and running at 0.65 normal rating for 2-3 min) or at a depot for a term of 1-3 months, the engine must be subjected to all-over processing. If necessary, the storage term for the engine on the helicopter may be prolonged to 3 months, provided the engine is additionally subjected to inner and outer processing and then again to complete processing.

In case a non-processed engine is dismantled from the helicopter and engine cold cranking for processing the fuel system is impossible, remove the accessories of the fuel system one by one and subject them to anti-corrosive treatment not later than 24 hours after their removal. The treatment procedure is given in Operating and Maintenance Instructions on IL-25B engine and P-7 gear box.

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Partial processing of the engine confined only to processing of the fuel system is resorted to only when the periods of inoperation do not exceed 20-30 days (with the engine kept inoperative on the helicopter). Should it become necessary to prolong the period of inoperation above the specified limits the engine fuel system must be processed anew each time 30 days expire.

Note. Prior to prolonging the storage term of a partially processed engine, make a thorough examination of the engine outer surfaces. All corroded areas on surfaces void of protective coatings must be cleaned with fine grain emery cloth wetted in oil, polished with paste POM and washed with clean gasoline. Then the areas thus treated must be coated with corrosion-preventive compound.

(C) Fuel System Processing

The engine fuel system as well as fuel system accessories removed from the engine is processed by means of a special rig comprising a closed tank provided with a heating appliance to heat the oil in the tank up to temperature within 60-70°C, oil pump, oil filter at the pump outlet, and a hose with a set of adapters to connect the rig to connections and pipes of the fuel system.

Fuel system processing procedure is as follows:

1. Fill the tank of the rig with a specified grade of oil heated to 60-70°C.
 2. Disconnect the pipe running to the fuel pressure gauge. Insert a special appliance (19-837) belonging to the engine inboard tool case between the connection and the pipe running to the fuel pressure gauge. The other end of this appliance must be connected to the main fuel manifold (after the manifold plug is removed).
 3. Start the pump of the rig and pump the oil until 2 or 3 litres of it run out of the hose. Here stop the pump and connect the hose of the rig to the inlet connection of unit 707, after disconnecting the supply piping from it.
 4. Remove the plug from the HP-23A pump air bleed connection and install an appliance to effect air bleed from the system. Then start the pump of the rig, and pump the oil until it fills the HP-23A pump running out of the air bleed hole. After this remove the air bleed appliance and plug the pump air bleed hole.
 5. With the rig pump running, crank the cold engine. The rig outlet oil pressure must be within 2.5-3.5 kg/sq cm. During the process of cranking set stop cock K0 from the CLOSED position to the OPEN position. Then 5-10 sec before the end of the cranking procedure reset the cock to its initial position (CLOSED). The cranking procedure over, stop the pump of the rig and disconnect the hose from unit 707. Connect the supply piping, instead.
 6. Remove appliance 19-837 and connect the pipe running to the fuel pressure gauge.
 7. Close the air blow-off bands fixing them in position with special bolts supplied together with the engine (ref. to Para.10, Page 8).
 8. A partially processed engine need not be deprocessed.
- In case the inoperative period for the engine in situ is supposed not to exceed 20 days, processing is not necessary. Inner ducts of the engine fuel system are sufficiently protected in this case with fuel filling the system (the system must not be drained). To prolong this period of storage above the specified 20 days, start the engine, warm it up and run for 3-5 min at 0.66 normal rating. Every 10 succeeding days perform either cold cranking or hot starting (starting, warming up, running for 3-5 min at 0.66 normal rating), successively.

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(3) Main Gear Box

There is no need to process the main gear box if the period of inoperation does not exceed 20 days. When this period amounts to more than 20 days, start the engines and run them for 3-5 min at 0.66 normal rating to warm up the main gear box every 20 days of inoperation.

In all cases the main gear box is removed from the helicopter, or kept on the helicopter during more than 30 days, without any possibility to effect the above starting and warming up, processing is obligatory.

To process the main gear box, stick to the following procedure:

1. While the main gear box is still warm, drain the entire oil system of the gear box of oil.

2. Remove the magnetic plugs and oil filters, wash them in clean gasoline or engine fuel and then dry with compressed air.

3. Reinstall the magnetic plugs and oil filters.

4. Fill the gear box oil system with fresh oil MK-22 or MC-20.

5. Warm up the gear box with the engine running at the ratings specified for the engine processing.

6. Drain off oil MK-22 or MC-20 from the gear box system completely.

Note. The oil drained after gear box processing may be continuously used for processing purposes, provided it is stored under proper conditions and is subjected to analysis each time before use.

7. Use a clean piece of cloth wetted in gasoline to wipe the outer surfaces of the gear box and transmission. Then take a dry piece of cloth to wipe these surfaces anew.

8. All the outer surfaces of the gear box and the surfaces of the parts void of paint-varnish coating must be coated with a layer of petrolatum heated to 60-70°C.

9. Apply a coat of petrolatum to the breather, wrap it up in two layers of paraffine paper and bind it over with twine.

10. The gear box thus prepared may be placed for storage during a period of time not exceeding 3 months. If due to some reason or other this period is to be prolonged, the gear box must be necessarily deprocessed in accordance with the Operating Instructions on the A-25B engine and then processed anew as is set forth above, save that the magnetic plugs and the oil filters need not be removed or washed.

11. Processing of the main gear box before its removal from the helicopter is quite identical to processing a gear box to be left in situ on the helicopter for a period of up to 3 months. Anti-corrosion treatment of the gear box outer surfaces is performed in this case after the gear box is removed from the helicopter.

Note. Outer surfaces of a gear box to be stored for a long period of time in situ on the helicopter are processed directly on the helicopter.

(4) Main Rotor Hub and SwashplateA. Processing

In case the helicopter inoperation is supposed to last from 1 to 6 months, subject the hub and swashplate of the main rotor to anti-corrosion treatment in the following way:

1. Lubricate and refill all the items subject to lubrication in service (using specified grade lubricants for the purpose).

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2. Fill to capacity the compensation tank with hydraulic fluid AMT-10.
3. Wipe all the outer surfaces of the component units with clean cloth wetted in gasoline E-70.

Notes. Keep gasoline off closed-type bearings (with protective discs) of the centrifugal blade droop limiters.

4. Apply a thick coat of lubricant to all the outer non-painted surfaces, using a brush or a pulverizer. The lubricant must be heated to 60-70°C.

To process the main rotor hub, remove the rubber boots from the hydraulic damper cylinders, screw out the sleeves of the damper caps and apply a coat of petrolatum (FOCT 6757-53) to the extended portions of the cylinder rods. After this replace the sleeves and boots.

Prior to this process dehydrate the petrolatum to be used. To this end keep it for 12-20 min at a temperature within 105-110°C.

B. Deprocessing

Remove the protective coat of petrolatum with clean cloth wetted in gasoline E-70.

To deprocess the hydraulic damper rods: remove the rubber boots from the damper cylinders and screw out the damper cap sleeves.

Petrolatum removed, replace the sleeves and boots.

Notes: During processing or deprocessing:

1. Be sure gasoline does not get into closed-type bearings (with protective discs) of the blade droop centrifugal limiters.
2. Keep gasoline, kerosene, oil off rubber components and surfaces coated with varnish or paint.

(5) Transmission Accessories

A. Processing

Transmission accessories are subjected to anti-corrosion treatment each time the inoperation period is supposed to last for over 10 days (see chapter III p.284)

In this case the transmission is engaged during engine processing in accordance with the respective instructions.

If the period of inoperation lasts from 1 to 6 months, the processing procedure is as follows:

1. Drain oil from the intermediate and tail gear boxes (they must be still warm), remove the filters and wash them in gasoline, remove and wash in gasoline the plug of the intermediate gear box.
2. Fill the gear boxes with fresh hypoid gear oil (FOCT 4003-53) up to the upper notches on the dipsticks.
3. Syringe hypoid gear oil (FOCT 4003-53) into all the splined joints of the tail shaft and into the joints of the fan drive shaft.
4. Engage transmission to run it for 10 min at free turbine r.p.m. equalling 78% (by the tachometer). Do not drain oil from the gear boxes.
5. All the outer non-protected surfaces of the tail and intermediate gear boxes, tail shaft, rotor brake, and fan must be coated with neutral petrolatum.

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B. Deprocessing

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To deprocess the transmission, drain oil from the intermediate and tail gear boxes, and wash all the outer surfaces coated with petrolatum, applying gasoline with the help of a brush or a piece of cloth.

Notes: During processing or deprocessing:

1. Be sure gasoline does not get into closed-type bearings of the tail shaft. Never use brushes to wash away petrolatum from the bearing surfaces. Use cloth, instead, slightly wetted with gasoline.
2. Keep petrolatum off the friction surfaces of the brake drum and shoes.

(5) Main Rotor Blades

1. After the engine processing run detach the blades from the main rotor hub (see also Chapter VI of Part II).
 2. With the help of soapy water remove all oil and grease stains, wash these areas with warm water and wipe them dry, using soft cloth.
 3. Restore paint coating, if necessary.
 4. Apply neutral petrolatum or gun grease to the eye lugs of the blade spar shank. Wrap them in paraffine paper and bind them over with twine. Clean drain holes.
 5. If blades are stored on trestles in the open, at least once a month remove covers from them and leave them uncovered for a whole day (in clear weather). (2)
- If blades are stored in premises, air the blades with the covers removed for 2 or 3 days not rarer than once every two months.

(6) Tail Rotor

1. Wash off all oil or grease stains from the blade surfaces, using soapy water. Then wipe the blades dry. Restore paint coating, if necessary.
2. Repack feathering hinges, push-pull rod ball joints, and tail rotor actuating rod bearings.
3. Apply a thin coat of petrolatum or gun grease to the blade shank and hub outer surfaces.

III. CARE OF MAGNESIUM-ALLOY PARTS

Special attention should be paid to condition of the protective layer on the magnesium-alloy parts. Corrosion on these parts is evidenced by swells on the paint coating and by spongy-type grayish corrosion products on the metal surfaces.

Corrosion in this case may be provoked by:

1. Foreign inclusions in alloy.
2. Inadequate surface cleaning before painting.
3. Improper oxidizing before paint-coating.
4. Omission of oxidizing before painting.
5. Damage to protective coating.
6. Dust or dirt accumulations on part surfaces.
7. Effect of chemical reagents (active gas, sea water, etc.).
8. Contact of magnesium-alloy parts with steel, brass, nickel and their alloys.

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When examining the parts made of magnesium alloy, pay special attention to condition of protective coatings and cleanliness of surfaces. Timely remove dust or dirt accumulations, since damp dust acts as electrolyte, thus causing severe corrosion.

In case solutions of salts, or alkali, or fire-extinguisher foam get on the surfaces of the magnesium-alloy parts, immediately wash them off with warm water, dry them and wipe with gasoline-wetted cloth. Special care should be exercised to remove solutions from the joints of the parts. Do not fail to blow these places dry with compressed air after the wash-off procedure. It is also highly recommendable to keep an eye on the parts exposed to the above solutions and to check their condition each of the 5 succeeding days. Replace all parts having badly-corroded surfaces, with a considerable number of deep pittings all over the surface as well as parts having single deep pits on basic surfaces.

When magnesium-alloy parts are to be assembled with ball bearings and steel parts in flexible joints, the contacting surfaces must be liberally coated with gun grease. Contacting surfaces in immovable bolted joints must be coated with AJT-I primer. Threaded connections comprising magnesium-alloy parts and parts of other metals are protected as follows:

- (a) aluminium alloy parts are coated with AJT-I primer;
- (b) magnesium alloy parts are protected by treating them with selenious acid and then coating them with gun grease;
- (c) steel parts must be zinc-plated.

Riveted joints must meet the following requirements:

- (a) use only aged D-18 alloy rivets or fresh-tempered M18 alloy rivets;
- (b) all rivets must be subjected to oxidizing and succeedingly treated with potassium bichromate or zinc-plated to a depth of not less than 5 microns;
- (c) prior to inserting the rivets, coat them with AJT-I primer.

Any swelling of the protective coating must be cleaned off to allow examination of the metal surface. Then the coating is restored in the procedure given below.

First thoroughly clean the area having a swelling or stains betraying corrosion of all corrosion products by means of sandcloth, or a scraper, or a face-cutter, then wash it with gasoline (several times to make it absolutely clean), and wipe it dry.

Then remove the coating around this area, expanding it by 5-10 mm. Restore the oxide film on the prepared area by treating the surface with a solution of selenious acid with the help of a brush (this operation is performed only at temperatures not below zero). When the treated area dries completely in the air, brush the first layer of zinc-chromate primer AJT-I and let it dry for 24 hours at a temperature within 18-25°C or 36 hours at a temperature within 12-17°C. After this brush the second layer of AJT-I primer, and then let it dry with the rate and method specified above for the first layer. Then apply a coat of enamel of a required colour.

Exposure of surfaces to moisture is impermissible throughout the entire process of corrosion-cleaning and protective-coat restoration.

The solution of selenious acid must have the following composition:

selenious acid	20 gr;
soda bichromate	10 gr;
water	1 lit.

Use clean glass vessels with lapped-in covers (or stoppers) to prepare the solution and to store it. Exercise extreme care to keep off the solution from your skin, since it causes burns.

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Chapter VIII

MAINTENANCE OPERATIONS PERFORMED IN AIRFIELD

I. HELICOPTER TOWING

The helicopter is towed with a tractor truck by means of the B9550-00 tow bar attached to the nose and main L.G. shock struts. The tow bar is attached to the nose strut rigidly, by means of an axle pin inserted in the axles of the wheels and to the main landing gear by means of a tow cable (see Fig.65). The design of the tow bar allows for 60° turns to either side from the route line. In this case the tow cable should not touch the wheels of the nose landing gear.

(1) Attachment of Tow Bar to Helicopter

1. Lift the tow bar by hands and bring it to the helicopter so that sleeves 10 match the outer faces of the nose wheels.
2. Pass pin 12 through the sleeves and axles of the nose wheels and lock it in place with handle 13.
3. Connect the ends of the tow cable (shackle 11) to the front braces of the main landing gear struts.

Note. The length of the tow cable should be adjusted so that after attachment of the cable to the braces the cable is not sagging.

(2) Towing Instructions

1. When towing the helicopter over the airfield the main rotor should be braked in such a position that none of the blades is placed above the tail boom.
2. Before towing the helicopter for a long distance over rough roads the blades of the main and the tail rotors should be removed.
3. Do not tow the helicopter by hilly roads and the roads with high elevations.
4. During the towing period one member of the crew should remain in the crew cabin for control of the helicopter brake.
5. The towing speed should not exceed 6 km/hr.
6. Starting from the stop and towing should be carried out without jerks.
7. Turning of the helicopter round one of its main legs is prohibited.
8. Prior to towing, the tow bar should be thoroughly inspected. Use of the tow bar with deformed tubes of the truss, burred wires of the cables and unreliable attachment of rollers is not allowed.
9. In case of breakage of the 3024-12-104 safety bolt never replace it with a stronger bolt.

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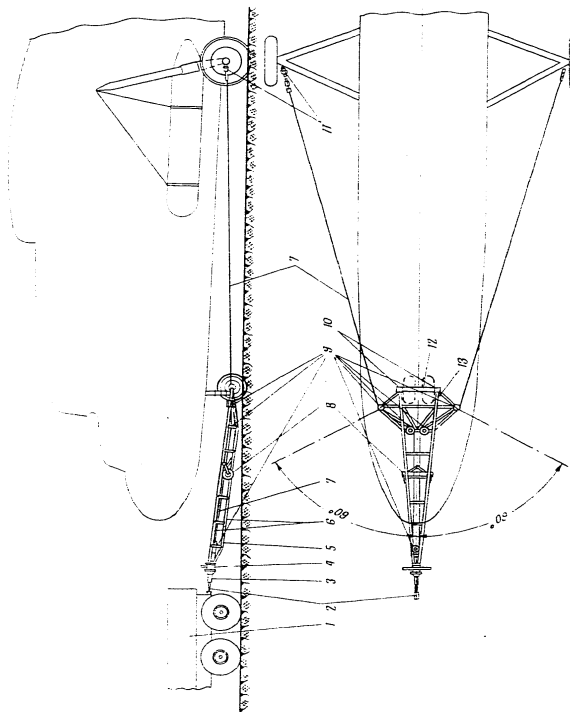


FIG. 65. GENERAL VIEW OF THE BAR
 1 - tractor; 2 - shackle to be engaged with tractor hook; 3 - main bar; 4 - shock absorber; 5 - tow bar mass; 6 - mass longitudinal tubes; 7 - tow cable; 8 - tow bar wheels in retracted position; 9 - rollers; 10 - sleeves; 11 - shackles; 12 - axle pin; 13 - axle pin retraining handle.

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II. LIFTING OF HELICOPTER WITH HYDRAULIC JACKS

The Mi-6 helicopter is lifted with hydraulic jacks for removal of the shock struts, charging of shock struts, replacement of wheels of the main and nose legs, helicopter levelling and other jobs which cannot be performed without lifting of the helicopter.

The lifting set consists of four hydraulic jacks: two main jacks (drawing B9903-200) and two nose jacks (drawing B9903-300).

Each hydraulic jack is a hydraulic cylinder with three telescopically linked rods.

During helicopter lifting, AIT-IO oil supplied from the reservoir by the HP-01 hand-operated pump pushes the rods upward.

Prior to lifting, the upper rod of the hydraulic cylinder is placed under the lifting points of the fuselage.

Lowering of the helicopter is performed by a slow by-pass of oil from the hydraulic cylinder to the reservoir through the open valve. The hydraulic jacks are locked in the raised position by means of pawls and nuts screwed on the rods.

After locking the pressure in the hydraulic system is relieved (as in case of lowering of the hydraulic jack) by opening the valve.

(1) Helicopter Lifting

1. Lift the base plates of the hydraulic jacks manually and lock the wheel forks with king-pin lock 17, thereby preparing the hydraulic jack for movement by wheels.
2. Roll the hydraulic jacks under the jacking points of the fuselage: nose jacks - under jacking points located on frame No.1 and main jacks - under jacking points located on frame 22 (Figs 66 and 67).
3. Unlock the wheel forks, take the wheels away and lower the hydraulic jacks on the base plates.
4. Using a plumb weight, set the hydraulic jacks in true vertical position by laying suitable hard objects under the base plates. The allowable deviation of the plumb from the arrow is 4 mm, which corresponds to 3° of the hydraulic jack inclination.

- Note. If the ground is soft, place wooden boards under the base plates.
5. Turn off set screw until its spherical head enters the lifting socket of the fuselage.
 6. Unlock the nuts of rods by moving aside retaining pawls painted red (Fig.68).

CAUTION. To avoid breakage of the retaining pawls and stripping of thread of the screws attaching the pawls, manipulate the pump handle to make sure that the pawls have been disengaged.

7. Close valve installed near the pump by rotating the valve handwheel clockwise.

8. Rocking the pump handle, lift the helicopter. In lifting, do not allow misalignment of hydraulic jack rods. First lift the helicopter by the main jacks until the helicopter is placed in the flight line and then by the all four jacks simultaneously (Fig.69).

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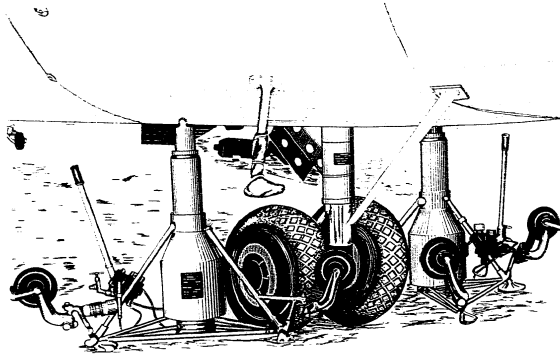


FIG. 66. INSTALLING NOSE JACKS UNDER JACKING POINTS OF FRAME No. 1.

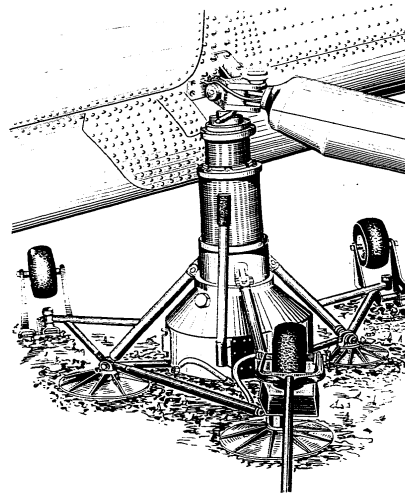


FIG. 67. INSTALLING MAIN JACKS UNDER JACKING POINTS OF FRAME No. 22.

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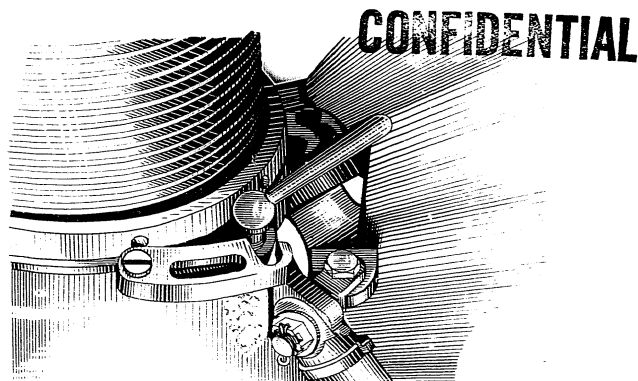


FIG. 68. DISENGAGEMENT OF RETAINING PARTS.

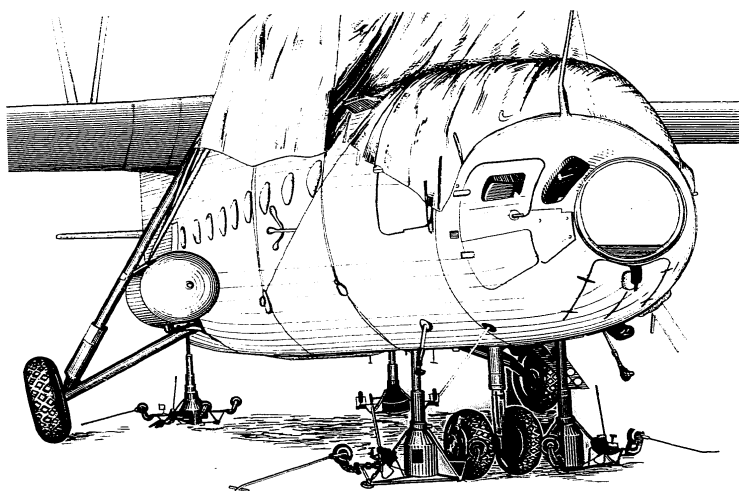


FIG. 69. LIFTING Mi-6 HELICOPTER BY HYDRAULIC JACKS.

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CAUTION. When lifting the helicopter, check the pressure in the hydraulic system of the jacks by the MP-250 pressure gauge installed on the hydraulic jacks.

If the pressure is beyond the maximum working limits it indicates that the rods are fully extended and bear against the limiting stops or are jammed. Further increase of pressure is not allowed because it may result in rupture of the hydraulic piping.

9. Move the rod nuts downward as far as they will go and lock them in this position.

10. Relieve the pressure in the hydraulic system of the jacks by turning the handwheel of valve counterclockwise.

(2) Helicopter Lowering

Manipulate all the four hydraulic jacks as follows:

1. Close the valve.
2. Rocking the pump handle, raise the pressure in the hydraulic system until it is sufficient for relieving the nuts.
3. Turn the nuts so that they travel upward home.
4. Open the valve (simultaneously on all the hydraulic jacks) to lower the helicopter.

Note. When lowering the helicopter, see that the rods of the hydraulic jacks move uniformly. The rate of helicopter lowering as well as movement of the hydraulic jack rods is adjusted by changing the turning angle of the valve handwheel. If the power rods do not lower completely, it is necessary to shift the nuts down, lock them with retaining pawls and, using a wrench, turn the nuts counterclockwise so as to lower the power rods until they bear against the limiting stop.

5. Install set screw 6 and remove the hydraulic jacks from under the helicopter.

(3) Helicopter Lifting for Removal of Nose Wheels

1. Install checks under the wheels of the helicopter main L.G. struts.
2. Place the nose hydraulic jacks under the jacking points of the fuselage located on frame No.1 near the nose wheels.
3. Lift the nose part of the helicopter by two nose hydraulic jacks.
4. Lower the jack located near the wheel to be replaced by performing operations contained in Items 1-4, Section (2), and remove the jack.
5. Replace the wheels (Figs 70 and 71).
6. Place the removed hydraulic jack again under the jacking point and raise the power rod until the set screw bears against the lifting socket of the fuselage and is loaded like the other nose hydraulic jack.
7. Lower the helicopter by performing operations contained in Section (2) on both nose hydraulic jacks.

Note. All operations carried out during lifting and lowering of the helicopter by the nose hydraulic jacks are similar to those described in Sections (1) and (2).

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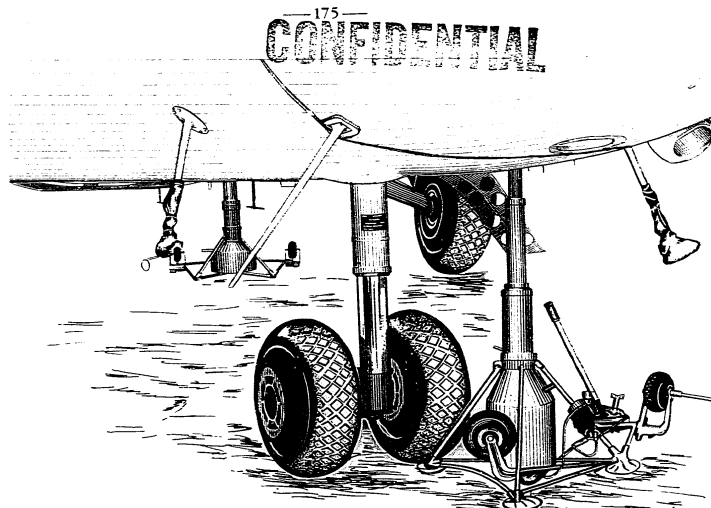


Fig. 70 Hydraulic jack installation under helicopter nose portion for mounting and removal of nose wheels. RETAINING NUTS OF THE OTHER JACK SHOULD BE BACKED OFF AND THE PRESSURE IN THE HYDRAULIC SYSTEM RELIEVED.

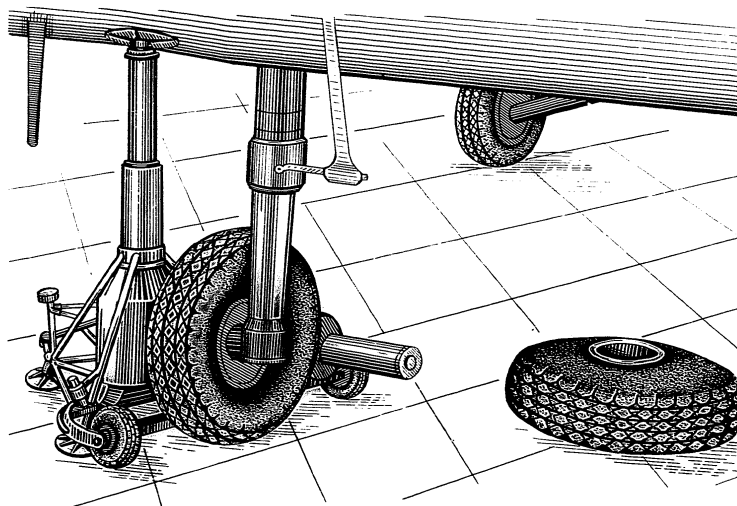


FIG. 71. REPLACING NOSE WHEEL (ONE HYDRAULIC JACK FOR NOSE SUPPORT IS REMOVED).

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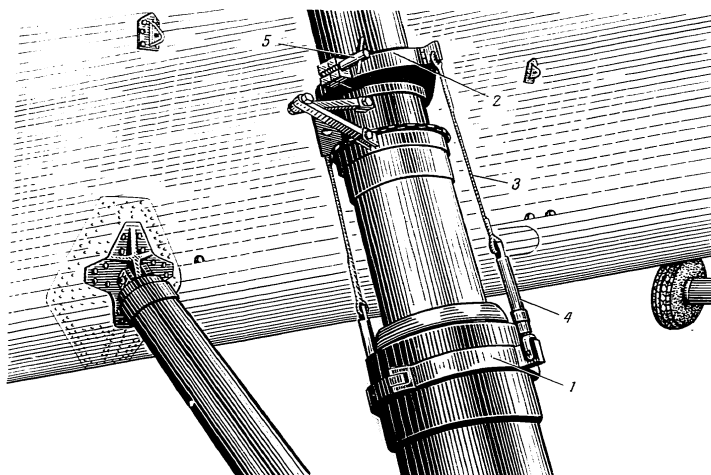


FIG. 72. FINING MAIN L.G. SHOCK STRUT BY MEANS OF 50-9903-290 APPLIANCE WITH PRESSURE IN HIGH- AND LOW-PRESSURE CHAMBERS RELEASED AND SHOCK STRUTS FULLY COMPRESSED
1 - clamp on high-pressure chamber; 2 - clamp on low-pressure chamber; 3 - wire rope; 4 - turnbuckle; 5 - eye-bolt with nut.

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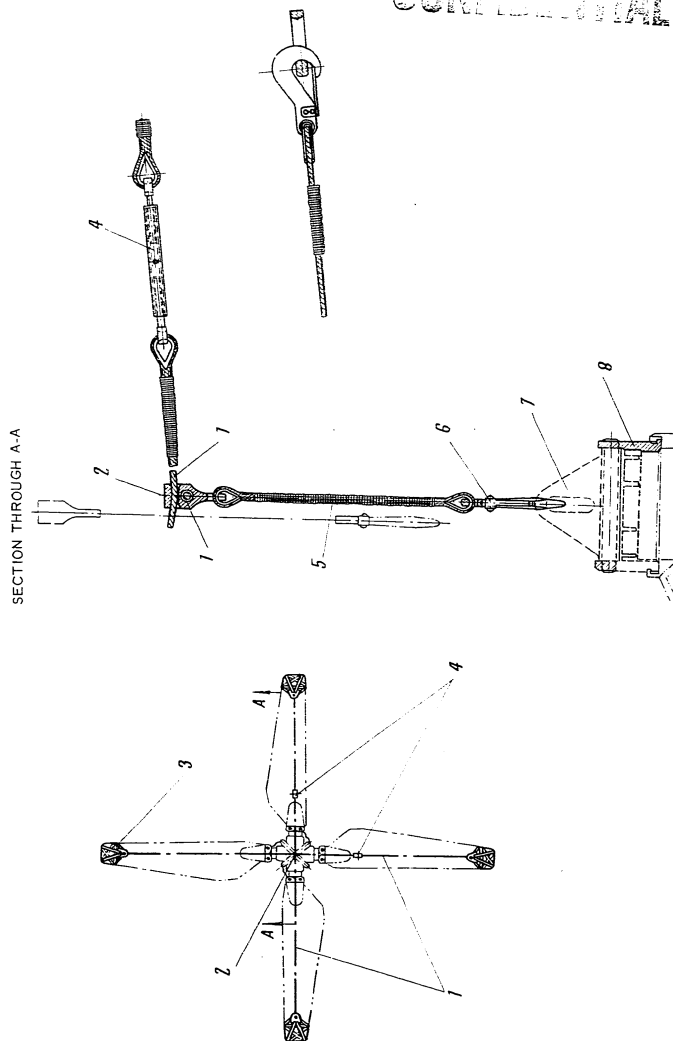


FIG. 73. FASTENING TAIL ROTOR BLADES
1 - fastening wire ropes, 4.5 mm in diameter; 2 - shackle; 3 - blade tip jacks; 4 - turnbuckles; 5 - fastening ropes-to-tail rotor hub attachment wire rope, 2.5 mm in diameter; 6 - fastener; 7 - eye lug, screwed into attachment nut of tail rotor hub spider; 8 -

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(A.) Helicopter Lifting and Replacement of
Main Wheels with Pressure Relieved
from Shock Strut

1. Place hydraulic jacks (main and nose) under the jacking points of the helicopter fuselage.
2. Relieve the remaining pressure in the low- and high-pressure chambers of the shock strut.
3. Lock the main shock strut in place by means of the 50-9903-290 appliance (Fig.72).

CAUTION. Never lock the shock struts with the 50-9903-290 appliance if the pressure in the high- and low-pressure chambers is not completely relieved.

4. Lift the helicopter by performing operations contained in Section (1).

Notes: 1. When the pressure in both shock struts of the main landing gear is relieved, the pneumatic tyres of the main landing gear are deflected and it is impossible to place the main hydraulic jacks under the jacking points of the fuselage relieve pressure in the shock strut of the nose landing gear. If this measure proves to be ineffective, it is recommended to deflate the pneumatic tyres of the nose landing gear.
2. When it appears possible to install one of the main hydraulic jacks, the latter should be used for lifting the helicopter to the extent required for installation of the other main hydraulic jack.

5. Replace the wheel.
6. Lower the helicopter.
7. Remove the 50-9903-290 appliance which locks the shock strut in place and charge the shock struts as required.

Note. The work over, lower the power rods of the hydraulic jacks completely and put jackets on them.

III. FASTENING TAIL ROTOR BLADES

The blades of the tail rotor are to be fastened when the wind velocity exceeds 20 m/sec.

The fastening device holds the blades to the brackets of the horizontal hinges and protects them from damage.

The blades of the tail rotor are fastened as follows:

1. Set the pedals in neutral position.
2. Disengage turnbuckles 4 of fastening wire ropes 1 (see Fig.73).
3. Using the M9229-250 ladder, put tip jackets 3 on the blade tips and connect the turnbuckles of the wire ropes.
4. Attach the fastening device to the tail rotor hub by engaging fastener 6 with eye lug 7.
5. Using turnbuckles 4, tighten up the wire ropes with the blades set at the stops. Both wire ropes 1 should be tightened with an equal effort.

Note. When the blades are fastened without the use of protective jackets care should be taken not to damage the blades by fasteners and rings of the tie-down jackets.⑨

IV. PUTTING JACKETS ON HELICOPTER

To prevent undue atmospheric effects, the helicopter is provided with the following set of jackets (see Fig.74):

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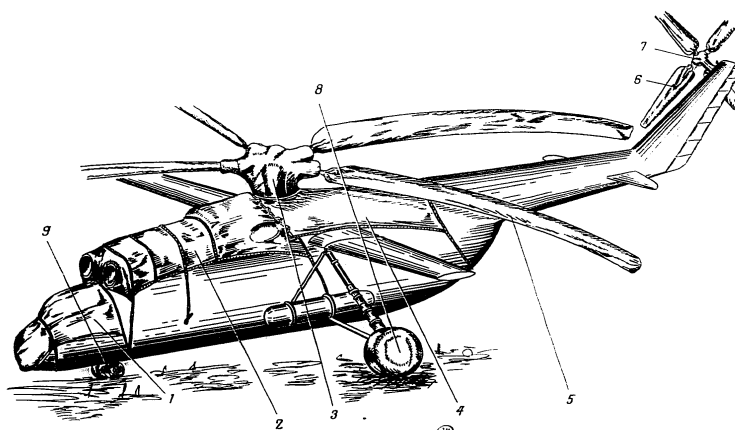


FIG. 74. COVERING HELICOPTER WITH JACKETS (29)

1 - fuselage nose jacket; 2 - engine cowls jacket; 3 - main rotor hub jacket; 4 - gear box cowl jacket; 5 - main rotor blade jacket; 6 - tail rotor blade jacket; 7 - tail rotor hub jacket; 8 - main L.G. wheels jacket; 9 - nose L.G. wheels jacket.

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- *jacket for the blade of the tail rotor (Drawing 50-9603-10)*
- jacket for the nose portion of the fuselage (Drawing B9602-100-7);
- jacket for the engine cowls (Drawing B9602-100-11);
- jacket for the rotor hub (Drawing B9602-100-13);
- jacket for the gear box cowl (Drawing B9602-100-21);
- protective jackets for main rotor blades (Drawing B9603-00);
- jacket for the hub and the blade of the tail rotor (Drawing 50-9603-11);
- jackets for the wheels of the main landing gear (Drawing 50-9602-160);
- jackets for the nose strut wheels (Drawing 50-9602-165);

To put jackets on the helicopter, proceed as follows:

1. Close the inlet and outlet ducts of the engines, the fan and exhaust pipes with shutters or blanking covers.
2. Using the 50-9912-50 fork and auxiliary slings, put the jackets on the main rotor blades. When doing so, take care not to bend the trim tabs.
3. Using the M9229-250 ladder, put the jackets on the blades and the hub of the tail rotor.
4. Put jackets on the nose portion of the fuselage.
5. Put the jacket on the engine cowls.
6. Put the jacket on the main rotor hub. The main rotor should be braked.
7. Put the jacket on the gear box cowl.
8. Put jackets on the wheels of the main and nose landing gear struts.

Notes: 1. In summer time in good weather jackets should be put only on the nose portion of the fuselage and engine cowls.
 2. Wet and dirty jackets should not be used until they are dried and cleaned.

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Chapter IX

REPLACEMENT OF HELICOPTER SEPARATE ACCESSORIES

The present Chapter deals with removal and installation of the helicopter main accessories (transmission, main and tail rotors, engines and other accessories) performed in the using organizations.

To ensure correct performance of jobs described in the respective Sections of the Chapter it is necessary to use special tools and appliances specified in the Instructions and shipped by the Manufacturer.

Removal and installation of accessories on the helicopter should be carried out by means of a crane with a loading capacity of not less than 7.5 tons and the boom reach not less than 18 metres (cranes K-104, K-111 and K-124).

I. REPLACEMENT OF A-25B ENGINES

(1) Removal

1. Drain oil and fuel from the engines and the systems. Drain oil from the main gear box. Perform processing operations on the interior of the engines and the fuel system in conformity with "The A-25B Engine Operating Instructions".

Note. The oil should be drained off through the funnel fitted with a screen. The screen should be checked for metal particles or chips. In case metal chips are found replace the oil coolers, remove the oil tank from the helicopter and wash it with clean gasoline or kerosene. The pipelines may be washed with clean gasoline or kerosene without removing them from the helicopter.

2. Disconnect the throttle control link-rods, stop cock control wire rope, bunched electric cables, heating and ventilation pipe-line and all piping of the fuel, oil, air, and the fire fighting systems from the engine.

Disconnect all clamps and brackets attaching the pipes and bunched electric cables from the structural elements of the cowls of the fan and central compartments.

The disconnected ends of the pipes, bunched cables and trunks should be closed with caps, wrapped up with cellophane and tied.

3. Disassemble the fan compartment cowls 7, 8, and 9 of central compartment 23 and front compartments 4, 25 (Fig.75).

4. Turn off the attachment screws and remove the baffle wall of the fan compartment of cowls (Fig.76).

5. Disassemble and remove the longitudinal fire bulkhead and side plates of lateral fire bulkhead 2 from the helicopter (Fig.77).

All the jobs should be performed with the use of the work platforms of the right engine in the following manner:

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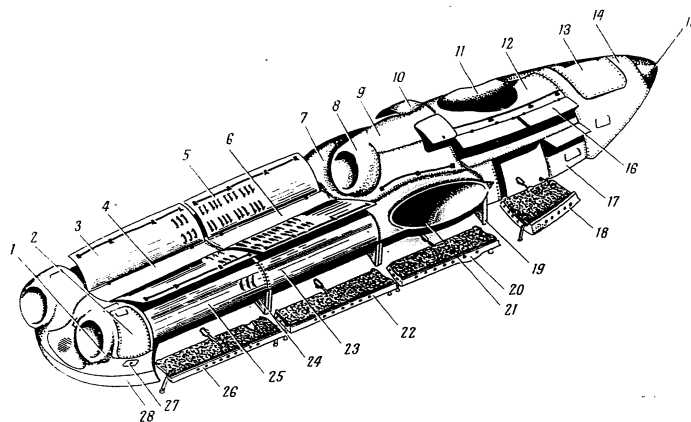
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FIG. 75. ENGINE AND MAIN GEAR BOX COWLS

1 - engine air intake ducts; 2 - oil tanks cover; 3 - front compartment cover; 4 - front compartment access panel; 5 - central compartment cover; 6 - central compartment hatch cover; 7 - fan compartment access panel; 8 - fan air inlet scoop; 9 - upper section of fan compartment cowl; 10 - cover; 11 - channel for passage of main gear box shaft; 12 - gear box cowl; 13 - hatch cover; 14 - cowl rear compartment; 15 - air outlet duct; 16 - gear box cowl cover; 17 - access panel; 18 - retractable platform of gear box cowl; 19 - frame of fan and gear box cowls; 20 - fan compartment platform; 21 - exhaust pipe; 22 - central compartment platform; 23 - cowl central compartment access panel; 24 - fire bulkhead; 25 - front compartment access panel; 26 - front compartment platform; 27 - access panel for oil draining from tanks; 28 - apron panel of engine air intake ducts.

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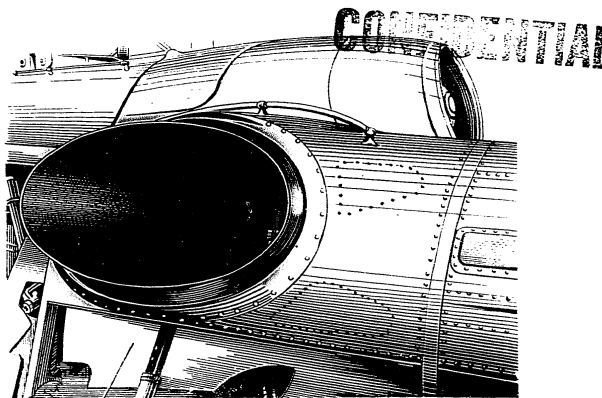


FIG. 76. FAN COMPARTMENT COWLS
1 - shield of fan compartment cowls.

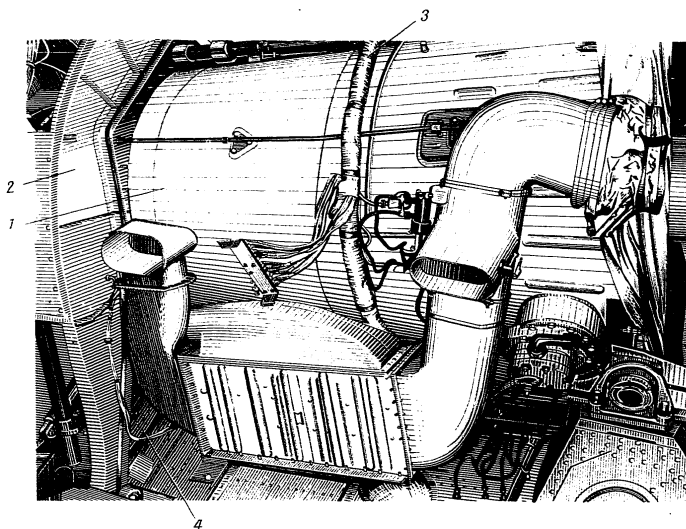


FIG. 77. ATTACHMENT OF FIRE BULKHEAD ON J-25B ENGINE
1 - J-25B engine; 2 - fire bulkhead side section; 3 - bunch conductor of engine thermocouples; 4 - fire bulkhead lower section.

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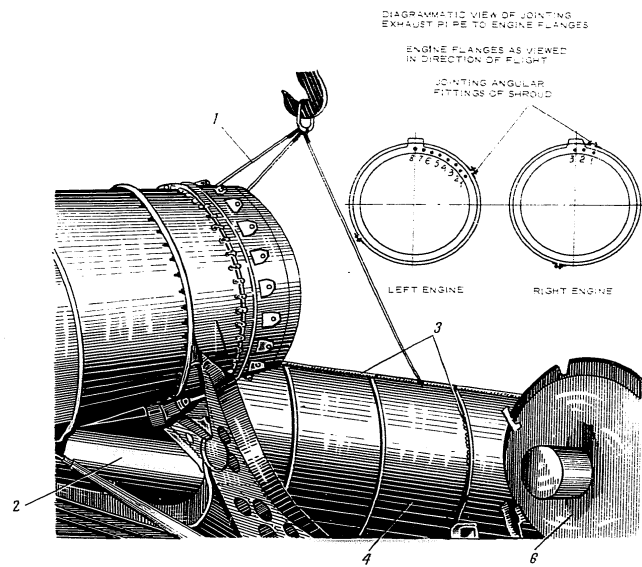


FIG. 78. ATTACHMENT OF J-25H ENGINE EXHAUST PIPE

1 - 63817 038.1 slings for lifting exhaust pipe; 2 - engine transmission shroud; 3 - attachment bolts of exhaust pipe shroud; 4 - exhaust pipe shroud; 5 - attachment bolts of exhaust pipe shroud; 6 - blanking cover for closing engine interior after separation of exhaust pipe.

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(a) incline the upper part of the central sheet of the longitudinal fire bulk-head and carefully lift it so as to disengage the handle of the fasteners of the central sheet.

Using the above method, remove two other sheets;

(b) turn off the attachment screws of the side plates of the lateral fire bulk-head and remove the side plates (Fig.77).

6. Fit slings 1 on the exhaust pipe of the left engine and install the ring of the slings on the crane hook (Fig.78).

Note. Attach the exhaust pipe to the slings with an additional rope fastened to the hot air trunk.

7. Turn off self-locking nuts 22 attaching the rear support of transmission shroud 20 to studs 23 of the main gear box (Fig.79).

8. Unlock and turn off bolts 13 attaching shroud expansion joint 16 to removable section 11 of the shroud.

9. Shift the rear expansion joint together with the support forward.

10. Remove oil supply pipe 15. To do it, compress spring 21, force the pipe back to the main gear box, lead the front end of the pipe from the retainer and withdraw the rear end of the pipe together with the spring from the tail-piece of the main gear box.

11. Disconnect retainer 17, remove half-rings 18 and shift tail shaft 14 of the left engine transmission forward.

12. Unlock and turn off nuts 9, disconnect removable section 11 of the shroud from the transportation casing and remove it together with the rear expansion joint from the helicopter.

13. Place wooden spacers between the shaft, shroud and the exhaust pipe to protect them from mechanical damage.

To prevent falling of the end shaft and transmission shroud, attach them with a rope to the slings of the exhaust pipe.

14. Unlock and turn off bolts attaching the exhaust pipe to the flange of the engine (Fig.78).

15. Carefully take the exhaust pipe away from the flange.

16. Unlock and turn off bolts 1 attaching front support 2 of the shroud of the transmission shaft to the left engine. Push the shroud together with the transmission shaft back to the main gear box until the splines of shaft 5 get out from roller coupling 4 and oil pipes 3 get out of the engine socket (Fig.79).

17. Using the 63817/0384 slings, lift the exhaust pipe together with transmission shroud 2 (Fig.78) of the left engine and lower it on the storage bench (caz. N° B9906-50)

18. Unlock and turn off bolts 5 attaching the exhaust pipe to the flange and remove the flange.

19. Install blanking cover 6 on the flange of the turbine housing of the left engine rotor (Fig.78) and put plug 1 on the shank of the main gear box shaft (Fig.108).

20. Remove the exhaust pipe of the right engine by performing operations specified in Items 6-18.

21. Turn off bolts 7 attaching the rim to the engine flange. Before doing it, remove bolts 6, 4 so that the adapter can be displaced as required (Fig.80).

22. Install cross-piece 1 on the lifting fittings of the left engine and put the ring of the cross-piece slings on the crank hook (Fig.81).

23. Turn off the bolts attaching the baffle walls at the engine journals and remove the baffle walls.

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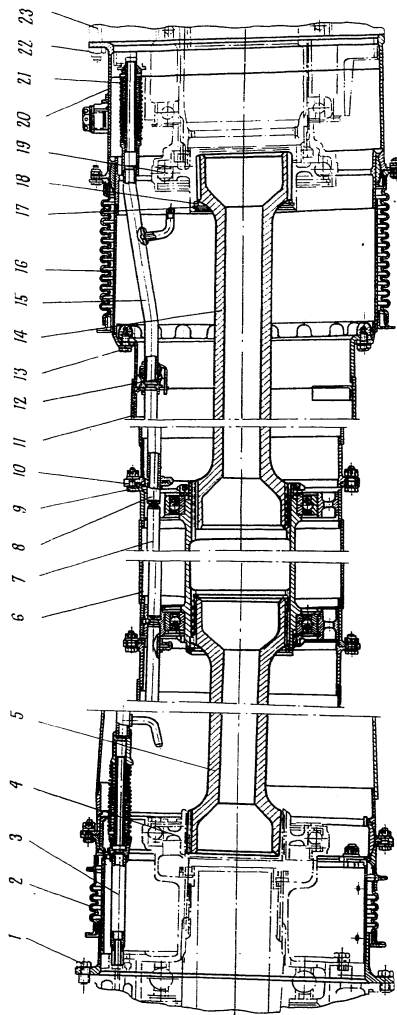


FIG. 79. ENGINE TRANSMISSION

1 - front support-to-engine flange attachment bolt; 2 - front support of transmission shroud; 3 - oil pipe to engine; 4 - engine roller coupling; 5 - front shaft of engine transmission; 6 - central section of transmission shroud; 7 - socket for oil pipe in central section of shroud; 8 - oil pipe in removable section of shroud; 9 - bolt for attaching removable section of shroud to central section; 10 - gasket; 11 - section of transmission shroud to be removed during transportation and assembly of engine transmission; 12 - oil pipe attachment fitting; 13 - bolt for attaching rear expansion joint to removable section of transmission shroud; 14 - oil shaft of engine transmission; 15 - removable oil pipe; 16 - rear expansion joint of transmission shroud; 17 - redliner; 18 - half-trings; 19 - gear box roller couplings; 20 - rear support of transmission shroud; 21 - spacer spring of oil pipe; 22 - nut for attaching rear support of transmission on main gear box studs; 23 - main gear box stud.

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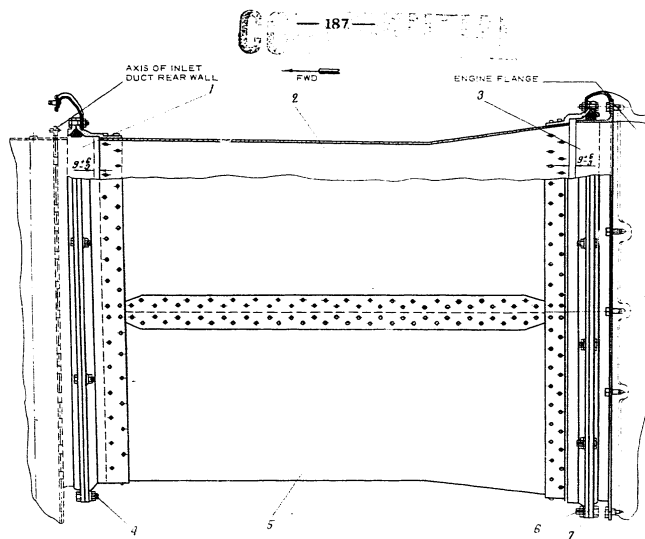


FIG. 80. INSTALLATION OF ADAPTER TUBE BETWEEN ENGINE AND INLET DUCT
 1 - intake duct rim; 2 - adapter tube skin; 3 - rim for adapter tube-to-engine attachment; 4 - adapter tube front flange-to-intake duct ring attachment bolt; 5 - adapter tube; 6 - adapter tube rear flange-to-engine rim ring attachment bolt; 7 - rim-to-engine attachment bolt.

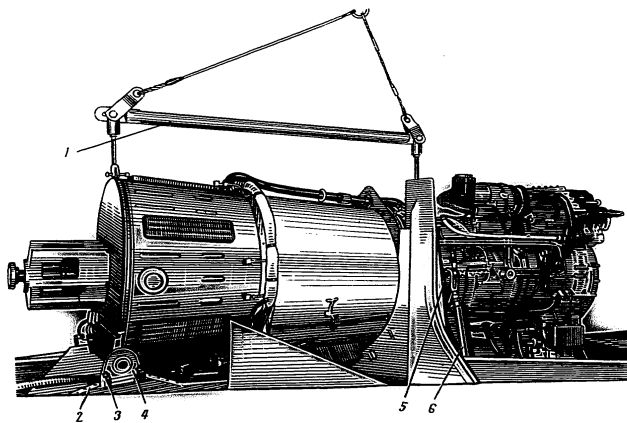


FIG. 81. INSTALLATION OF J-25B ENGINE IN FUSELAGE
 1 - 50-9901-500 cross-piece for lifting J-25B engine; 2 - B0348-10-30 rear support of engine in fuselage; 3 - bracket attachment bolts; 4 - B6400-01 bracket for attaching engine to fuselage; 5 - shock-absorber-to-engine attachment bolt; 6 - engine shock-absorbers.

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24. Supporting the engine with the crane, turn off the nuts and remove bolts 5 attaching the engine to shock-absorbers 6 (Fig.81). Turn off the nuts and remove bolts 3 attaching brackets 4 to supports 2.

25. Thoroughly check to see that all the systems are disconnected from the engine. Using the crane, lift the engine together with brackets 4 and then lower it.

26. Dismantle brackets 4 from the removed engine and install the engine on the wheeled stand for reassembly. Remove the cross-piece from the left engine.

27. Wipe brackets 4, sleeves 10, nuts 11 and 13 and washers 12 with a piece of cloth soaked in gasoline and inspect them for mechanical damage. Replace shock-absorbers 1 with new ones and fit the brackets with rubber shock-absorbers, sleeves and nuts (Fig.82).

CAUTION. Cold working on sleeves 14 and washers 12 is allowed. If the depth of cold working exceeds 1.5 mm, the defective parts should be turned round the axis of the engine journal through 180°. The operation should be recorded in the helicopter Service Log.

28. Remove the right engine by performing operations specified in Items 20-27.

29. Remove the HT3-2, JHPT-2 transmitters from the engine. Remove the AK-50M compressor from the left engine.

The seating flanges for the engine accessories should be closed with lids.

30. Remove the thermocouples and bunched conductors 3 attached to the engine flange (Fig.77).

31. Process the exterior of the left engine, exhaust pipe and transmission.

32. Perform operations specified in Items 28-30 on the right engine.

(2) Installation of H-25B Engines on Helicopter

A. Preliminary Operations

1. Make sure that the numbers of the engines and transmission correspond to those specified in their Service Logs. Deprocess the exterior of the engine, exhaust pipe and transmission.

2. Inspect the engine, transmission and the exhaust pipe for mechanical damage and presence of seals on blind caps.

3. Install the HT3-2, JHPT-2 transmitters and T-6 thermocouples of the 2TBT-366 set.

4. Install the AK-50M compressor on the left engine.

5. Attach bunched conductors 3 of the thermocouples to the engine flange (Fig.77).

6. Perform operations specified in Items 1-5 on the right engine.

B. Preliminary Installation of H-25B Engine

1. Put the ring of slings on the crane hook and fix cross-piece 1 to the shipping fittings of the left engine (Fig.81).

2. Lift the engine and install previously removed brackets 9 together with rubber shock-absorbers 1 on journals 2 (Fig.82).

3. Place the engine on the helicopter, carefully move it to the installation area and install on supports 2 of the fuselage (Fig.81).

NOTE: During helicopter operation, cold working on duralumin inner bushings (B6400-3) and on thrust washers (B6400-04) of the engine rear supports is allowed.

If, during engine replacement, cold working exceeding 1.5 mm is revealed the bushing and the washer should be turned round the journal through 180°. The operation should be recorded in helicopter Service Log.

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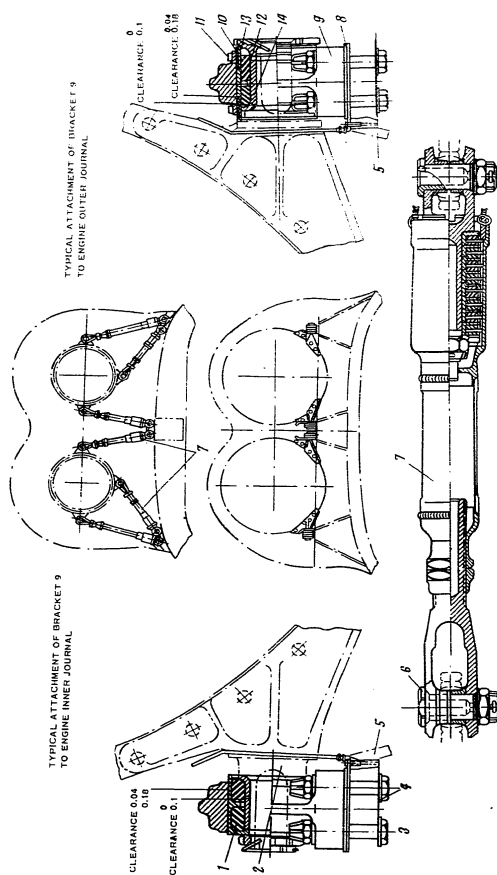


FIG. 82. INSTALLATION DIAGRAM AND ATTACHMENT FITTINGS OF 1L-25 ENGINES

1 - B6400-09 rubber shock-absorbers; 2 - engine journal; 3 - engine attachment bolt; 4 - 2A-12-12 adjusting screw; 5 - 40x58x10-10 support for engine attachment brackets; 6 - bolt for attaching shock-absorbers to engine; 7 - engine shock-absorbers; 8 - B6400-11 washers; 9 - B6400-11 washers; 10 - B6400-08 nut for attachment of B6400-02 sleeve; 11 - B6400-03 thrust washer; 12 - B6400-02 sleeve for axial displacement of journal; 13 - B6400-04 inner sleeve.

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4. Supporting the engine with the crane, install bolts 3 and fasten preliminary bracket 9 to the supports. The nuts should be tightened with a torque wrench. Torque = 7-9 kg-m. Place washers 3 (3402A-2-12-20) under the nuts and bolt heads (Fig.82).
5. Connect rubber shock-absorbers 7 to the engine and install bolts 6.
6. Remove the cross-piece together with slings from the installed engine.
7. Perform operations specified in Items 1-6 for preliminary installation of the right engine.

C. Checking and Adjusting Alignment of
Engines with Respect to Main
Gear Box

General

The alignment of the engines and the gear box is normally checked when the helicopter is parked on the ground, resting on its landing gear with empty fuel tanks, empty cargo compartment of the fuselage and with removed blades of the main rotor. In this case the helicopter should mount the basic accessories (the swash-plate, main rotor hub, tail transmission, tail rotor, both engines and the fan unit).

In case of necessity the check and adjustment of the alignment may be performed with partially or fully filled fuel tanks and the loaded cargo compartment of the fuselage provided the load placed in the cargo compartment does not exceed 6 tons and is located in compliance with the prescribed C.G. position.

During the adjustment procedure all other jobs on the helicopter should be discontinued and the personnel engaged in these jobs should leave the helicopter.

1. Install ladders between frames 8 and 15 on both sides of the helicopter. Place lateral benches on the ladders so that they pass above the ceiling of the cargo compartment near the rear support of the engines. The ladders and benches should not touch the helicopter because the weight of the personnel engaged in adjustment may cause deflection of the fuselage and thereby affect the accuracy of adjustment (Stage with cantilever stands 6383/2200).

2. Check the distance between the butt faces of the outer races of the engine and gear box roller couplings which must be within 2449 ± 2 mm (Fig.83).

3. Using the crane, lift and install appliance 1 on the studs attaching the transmission shroud on the main gear box and the left engine. The appliance is used for checking the alignment of shaft shanks of the engine and the gear box. Attach the appliance with bolts and nuts found on the engine and the gear box (Fig.84).

4. Fit appliance 1 with indicators so that the spindle of one of them bears against the butt face of the engine coupling and the spindle of the other, against the butt face of the gear box coupling (Fig.83). Preload the indicators to 2-3 mm (not less than 1.5 mm).

Note. Alignment of the engine with respect to the main gear box is carried out with account of the fuselage deformation in flight. With this in view, the shafts should be deflected to the side opposite to this deformation. This deflection in alignment ensures most favourable conditions for operation of the transmission shafts in flight. The magnitude of the deflection in the vertical plane as measured across the couplings of the engine and the gear box is illustrated in Fig.85.

5. Install the roller couplings of the engine and the gear box so that the mark lines on the butt faces of the couplings which indicate the maximum natural run-out

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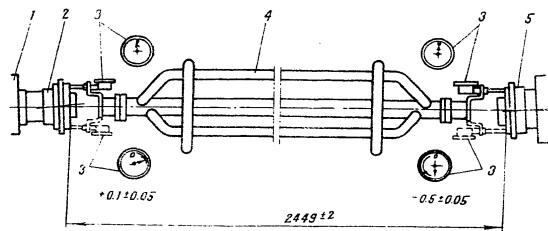


FIG. 83. CHECKING ENGINE AND MAIN GEAR BOX FOR AXIAL ALIGNMENT
1 - 1-250 engine housing; 2 - engine roller coupling; 3 - indicator; 4 - 63406 005A aligning device; 5 - gear box roller coupling.

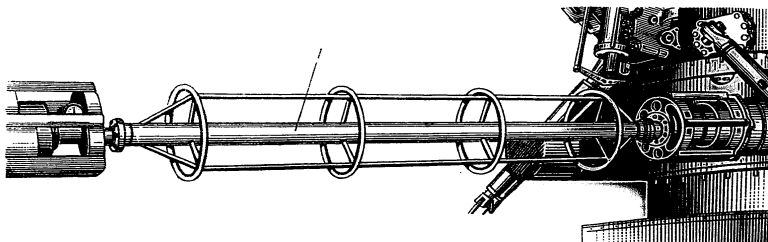


FIG. 84. APPLIANCE FOR CHECKING MAIN GEAR BOX AND ENGINE SHANKS FOR AXIAL ALIGNMENT
1 - 63406 005A appliance for checking axial alignment.

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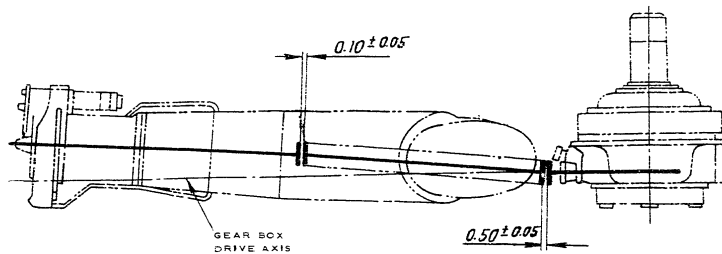
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FIG. 85. ALIGNMENT OF ENGINES AND MAIN GEAR BOX ON Mi-6 HELICOPTER (WITH ACCOUNT OF ANGULAR MISALIGNMENT FOR ADJUSTMENT ON GROUND; THIS MISALIGNMENT IS ELIMINATED IN FLIGHT).

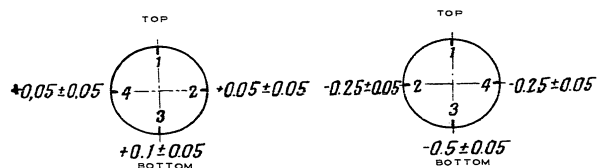


FIG. 86. CHECKING AND ADJUSTING ALIGNMENT OF ENGINES RELATIVE TO MAIN GEARBOX

1 — readings of indicator fitted on butt end of engine coupling; 2 — readings of indicator mounted on butt end of gear box coupling.

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of the couplings are placed in the upper position. The alignment check should be started from this particular position. The natural run-out of the couplings will be neglected.

6. Mark the four positions corresponding to the vertical and horizontal axes with paint or a pencil within a $\pm 2^\circ$ accuracy. For the 190-mm diameter it makes up ± 2.5 mm.

7. Install the indicator dial in top zero position.

8. Revolve appliance 1 (Fig.84) and record the indicator readings every $90^\circ \pm 2^\circ$.

9. When the alignment is adjusted correctly and the indicator dial is set in top zero position with the deviation directed to the side of the indicator considered as positive deviation and the deviation directed away from the indicator considered as negative deviation, the obtained data should conform to those indicated in Fig.86.

10. If the run-out in some points exceeds the allowable limits, the trouble should be corrected by displacement of the engine to the side opposite to the run-out.

Adjustment of the engine position should be started from eliminating the run-out of the gear box coupling. Vertical adjustment of the engine position is effected by selection of suitable thickness of a pack of shims 8 laid on the engine rear supports under the brackets. The adjustment may be performed within 8-17 mm (Fig.82). One 1-mm shim changes the run-out of the gear box coupling by about 0.1 mm. The transverse adjustment of the engine position is effected by displacement of the engine journals in brackets 3 of the rear supports by displacement of sleeve 10 in bracket 3 of the external rear support.

After elimination of the run-out of the gear box coupling, eliminate the run-out of the engine coupling. The inclination angle of the engine axis may be changed by adjustment of the length of shock-absorbers 7 without displacement of the engine on the rear supports.

To adjust the length of the shock-absorbers, remove bolts 6 from fork-shaped end-lugs and extend or shorten the shock absorbers. The above procedure is carried out when the engine is lifted with a crane by its cross-piece.

One turn of the fork-shaped end-lug of the vertical link-rod of the shock-absorber results in a 0.2 mm vertical displacement by the engine coupling.

Notes. 1. When adjusting the length of the shock-absorbers, see that the threaded portion of the fork closes the check hole in the sleeve.
2. To avoid twisting deformation of the engine, the vertical link-rods of the shock-absorbers should be adjusted by an equal number of turns.

11. Lock the nuts of bolts 3 with cotter pins, 2x30, and nuts 11 with YO-08 wire. Cotter-pin the nuts of bolts 6 (Fig.82).

12. Match the holes in rim 3 with those located on the engine front flange and attach the rim to the engine flange with bolts 7 (Fig.80).

Install adapter 5 between rims 1 and 3 so that after tightening of nuts and bolts 4 and 6 the gaps between the butt faces of the rims and the adapter are within 9_{-3}^{+6} mm.

13. The alignment of the left engine over, install the appliance and the cross-piece on the right engine and adjust alignment of the right engine with respect to the gear box by performing operations specified in Items 3-12.

14. The indicator readings taken during alignment of the left and right engines should be recorded in the Service Logs of the engines, main gear box and the helicopter in conformity with the diagram indicated in Fig.80.

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Installation of A-225 Engine Transmission

1. Install slings 1 in the exhaust pipe assembled with shroud 4 (Fig.78). Fix the exhaust pipe to the slings with an additional rope attached to the hot air trunk.

2. Install the front section of shroud 3 together with the transmission shaft and the funnel-shaped pipe union of the exhaust pipe (Fig.78). Insert tail shaft 14 into the hole of the intermediate section of the transmission shaft (Fig.79). To prevent the tail shaft from falling out of the transmission and the exhaust pipe, install wooden spacers between the shaft, shroud and the exhaust pipe.

3. At the end of the installation procedure the wooden spacers should be removed.

4. To prevent the engine transmission from falling out, attach it with a rope wire rope to the slings of the exhaust pipe.

5. Remove flange cover 6 (Fig.78) of the left engine and install the gasket made of asbestos fabric in the flange used for jointing the engine to the exhaust pipe.

6. Install the flange (from the exhaust pipe assembly) so that the set dowel pins of the flange are located in the horizontal plane.

7. Install retainers under the attachment bolts of the flange. Coat the bolts with heat-resistant grease "KO" and tighten them up.

8. Lock 16 bolts located in the inner low-quarter of the flange with the tabs of the retainers. The remaining bolts should be locked after final tightening (after start-up of the engines).

9. Check the interior of the transmission shaft shroud, exhaust pipe and the engine for foreign objects. Install a sealing ring on the flange attaching the transmission shroud to the engine.

10. Lift the exhaust pipe together with the transmission on the helicopter and carefully place it in the installation area between the engine and the gear box so that the two holes located on the exhaust pipe flange match the set dowel pins on the engine flange.

11. Carefully push the engine transmission out of the exhaust pipe and match the splines of shaft 5 with the splines of coupling 4 of the engine (Fig.79).

12. Insert oil pipe 3 protruding from the transmission shroud into the funnel-shaped pipe union located on the engine. Watch the check hole in the transmission shroud flange with the retainer located on the engine housing and make sure that the oil pipe has entered the funnel-shaped pipe union on the engine. Push the transmission forward home. Before doing it, place a rubber ring between the flange of the transmission shroud and the engine flange (Fig.79).

13. Install bolts 1 in the hole located on the flange of front support 2 of the transmission shroud, tighten them up and lock with KO-K1 wire (Fig.79).

14. Push the exhaust pipe towards the engine so that it seats on the flange and the set pins as required (see the jointing diagram of exhaust pipes in Fig.78).

15. Install the clamp on the joint of the exhaust pipe flange and the engine flange so that one of the turnbuckles is placed on the bottom side and uniformly tighten up all the bolts of the clamp turnbuckles.

Notes: 1. To ensure easy access to the turnbuckles it is allowed to turn the clamp within 45° to either side.
2. The turnbuckle bolts should be tightened up until the taper surfaces of the flanges and the inner ring of the clamp contact tightly. Then back off all the bolts by 1/3 of a turn and lock them with KO-K1.5 wire.

16. Lock the bolts in pairs by means of locking plates.

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14. Joint removable section 11 of the transmission shroud to central section 10 along the partition used for shipping. Before doing it, place gasket 10 between the sections of the shroud and match the ring of oil supply pipe 8 with gasket 10 (Fig.76).

15. Install bolts 9 in the matched holes of the flanges, put on washers, tighten up and lock the nuts.

16. Remove bolts 13 and shift rear expansion joint 16 together with rear support 20 forward in direction of flight. Install a sealing rubber ring on the flange attaching the transmission casing to the gear box.

17. Pull tail shaft 14 from the central section of the transmission shroud, support it to avoid sagging and insert into the splines of roller couplings 19 until it bears against the lock. Install half-rings 18 and lock them in place with retainer 17.

18. Make sure that the rings and the retainer are installed correctly. Push tail shaft 14 forward to the engine and measure the clearances between half-rings 18 and retainer 17. The clearances should be within 0.46-1.36 mm.

19. Revolve the transmission shafts by hand. The shafts should rotate readily, without binding.

20. Install the fittings of the telescopic linkage on oil supply pipe 15. Insert the pipe end fitted with spring 21 into the gear box shank, push it towards the main gear box at the expense of the spring and install the pipe end together with fitting 12 into the rear socket of pipe 8. Fitting 12 should get into the slot of pipe socket 8.

21. Make sure that there are no foreign objects inside the shroud. Push support 20 together with expansion joint 16 towards the main gear box, unfold the sealing rubber ring and install the flange of the support on studs 23.

22. Install and tighten up bolts 13. Lock the bolts with KC-11 wire.

23. Put nuts 22 on studs 23 and tighten them up with a wrench.

24. Remove the slings from the exhaust pipes.

25. Install the transmission and the exhaust pipe of the right engine according to the method employed for the left engine.

26. Install the longitudinal fire bulkheads and side plates of fire bulkhead 2 (Fig.77) on the helicopter. Install shield 1 of the fan compartment cowls (Fig.76).

27. Assemble the fuel, oil, air, fire fighting, heating and ventilation system lines, as well as the engine control link rods and electric wiring in the engine and fan compartments. Connect the system of air cooling of the GTP-12 TV starter-generators and the AK-50M compressor. Connect the control wire ropes of the stop cocks.

28. Assemble all the components of fan compartment cowl 7, 8, 9, central compartment cowl 23, and front compartment cowls 4, 25 (Fig.75).

29. Attach the piping and bunched wires on the cowls of compartments.

30. Inspect the removal and installation areas, check standard of installation, look for foreign objects and mechanical damage.

31. Energize the electrical equipment and check its functioning.

32. Check adjustment of the collective pitch-throttle control system as specified in the respective chapter of the present Instructions.

33. Deprocess the interior of the engines and the engine fuel system as specified in the A-25B Engine Operating Instructions.

34. After ground test-running of the engines check tightening of bolts 5 (Fig.78) attaching the flanges of the pipe attachment clamps which have been locked earlier. Lock the engine flange attachment bolts by bending the tabs of retainers on the bolt heads. 20

CAUTION:

When installing the engines check pipeline delivering oil to the turbine bearing for proper connection. Otherwise damage of the bearing is possible.

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1. REMOVAL OF MAIN ROTOR BLADES

(1) General

1. The main rotor blades should be removed or installed at still weather; the wind velocity should not exceed 10 m/sec.
2. The personnel engaged in jobs performed high above the ground should wear full-body belts.
3. The blades should not be revolved unless all the bolts are closed.

(2) Removal

1. Set the brake lever in the extreme lower position to unbrake the main rotor and place the blade to be removed at the left side of the crew cabin so that it is positioned at an angle of 45° with respect to the helicopter longitudinal axis. The main rotor hub should be turned by means of the 29715-040 wrench employed for revolving the transmission.
 2. Set the brake lever in the extreme upper position to brake the main rotor.
 3. Remove protective jacket 1, unlock and turn off the plug connector nut of harness wire 5 (Fig.87).
 4. Remove clamp 2 attaching the bunched wire to bracket 7.
 5. Remove clamp 3 attaching the bunched wire to bracket 4 of upper attachment (Fig.87).
 6. Remove cotter pins and turn off the nuts of the attachment bolts and remove washers from the bolts.
 7. Place 89957-00 Ladder under section No.6 of the blade to be removed.
 8. Open the access panel on section No.6 of the blade and engage blade-lifting sling 1 with the shackle (Fig.89).
 9. Move the crane jib to section No.6 and put the sling on the crane hook. Before doing it, slightly lift the blade to tighten the sling so as to take the strain off the upper attachment bolt.
 10. Tie the safety sling to the blade root.
 11. Using a drift and a sledge hammer, drive out upper attachment bolts 3 and remove spacer sleeve 1 (Fig.89).
 12. Using the crane, carefully lower the blade so that the cantilever portion of the blade rests into the hands of 2-3 workmen (Fig.89).
 13. Drive out the lower jointing bolt and remove bracket 4 (Fig.87).
 14. Carefully supporting the blade root with sling 1 and the cantilever section of the blade with hands, disengage the blade from the sleeve attachment fittings of the main rotor hub and lay the blade on the 50-9905-600 profiled supports placed under sections Nos 4-12 of the blade (Fig.89).
- CAUTION.** Never hold the tip fairing during removal and installation of blades to avoid its damage.
15. Remove the slings from the crane and disconnect them from the blade. Remove the safety sling from the blade root.
 16. Install the 63817/042 blade-lifting appliance on the blade (the straps should be fastened to sections Nos 5 and 12).
 17. Supporting the blade by hands (2-3 workmen at the blade root and the cantilever portion of the blade), lift the blade with the crane, place it on the 63800/000 blade transporting cart or on the 50-9905-600 profiled supports and remove the 63817/042 appliance.

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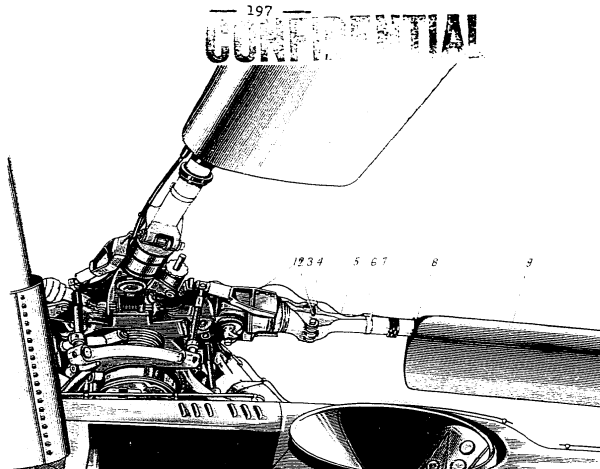


FIG. 87. BLADE-TO-MAIN ROTOR HUB ATTACHMENT

1 - bunched wire loop; 2 - bunched wire attachment clamp; 3 - attachment bolts;
4 - bracket; 5 - bunched wire; 6 - bunched wire attachment clamp; 7 - bracket;
8 - protective jacket; 9 - main rotor blade.

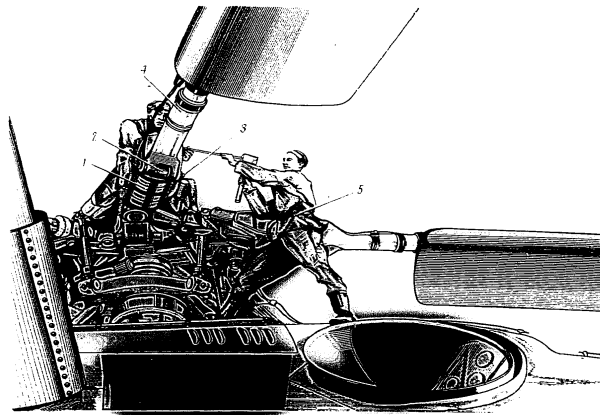


FIG. 88. REMOVING MAIN ROTOR BLADE

1 - main rotor hub sleeve; 2 - spacer sleeve; 3 - safety bolt; 4 - main rotor
blade root; 5 - hold-on belt.

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18. Coat the working surfaces of bolts, nuts, blade fittings and the rotor hub with ЛИАТИМ-201 grease.

19. Set the blades in the initial position one after another and remove the remaining blades from the helicopter.

(3) Installation

CAUTION. During installation of the blades see that the blade number conforms to the number of the blade sleeve of the main rotor hub.

1. Unbrake the main rotor and position the main rotor hub sleeve bearing the number of the blade to be installed as specified for the blade in Item 1, Para.1, Section (2) of the Present Chapter.

2. Brake the main rotor.

3. Install the 63817/042 appliance on the blade, put the ring of the appliance on the crane hook and tie safety sling 1 to the blade root.

4. Supporting the root and cantilever portion of the blade by hands, lift the blade from the cart (or profiled supports) with a crane and lay it on the 50-9905-600 profiled supports which should be placed on the ground along the axis of the rotor hub sleeve in which the blade is to be fitted.

5. Remove the 63817/042 appliance from the crane and the blade.

6. Open the access panel on section No.6 of the blade and put the B9901-200 blade-lifting sling on the shackle.

7. Bring the jib of the truck crane to section No.6, put the sling on the crane hook and, supporting the blade (by the wire rope at the root and by hands at the cantilever portion) carefully lift the blade with the crane so that the lower attachment fitting of the blade gets into the lower attachment fitting of the sleeve (Fig.89).

CAUTION. Never hold the tip fairing during removal and installation of the blades to avoid its damage.

8. Using a drift, match the holes of the attachment fittings of the blade and the sleeve, install lower attachment bolt 3 fitted with a washer, bracket 4 (Fig.87) and install the thread protecting cone.

Install spacer sleeve 2 and drive the bolt home by gentle strokes of a hammer (Fig.88).

9. Remove the protective cone and screw up the nut of the attachment bolt by hand.

10. Lift the blade with the crane so that the upper attachment fitting of the blade gets into the lower attachment fitting of the sleeve.

11. Using a drift, match the holes in the attachment fittings of the blade, sleeve and bracket 4 (Fig.87), install the upper attachment bolt fitted with a washer and a thread protecting cone. Install the spacer sleeve and drive the bolt home by gentle strokes of a hammer. Remove the protective cone from the bolt.

12. Lay washers under the nuts of the attachment bolts. Tighten up the nuts with a torque wrench ($M_{\text{torque}}=15-20 \text{ kg-m}$) and lock them with cotter pins.

13. Connect the plug connector of bunched wire 5, tighten up and lock the nut of the plug connector. Put protective jacket 8 on the plug connector. Fasten the jacket with "Mackay" thread.

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14. Attach the bunched wire to brackets 4 and 7 by means of the clamps so that there is a slight sagging of the bunched wire in the location of the blade spar as illustrated in Fig.87.

CAUTION. To ensure rotation of the blade relative to the hinges of the main rotor hub it is necessary to place the bunched wire in loops as illustrated in Fig.87.

15. Put the 89952-00 ladder under section No.6 of the blade to be installed, lower the crane hook and remove the sling.

16. Install the remaining blades as instructed in Paras 1-15 of the present Section.

17. Inspect the removal and installation areas, see that there are no foreign objects, mechanical damage and make sure that the parts have been correctly installed and reliably locked.

18. Check the main rotor blades for proper tracking and adjust as required.

III. REPLACEMENT OF MAIN ROTOR SLIP RING

(1) Removal of Slip Ring

1. Disconnect five hoses 3 of hydraulic damper 2 (Fig.90) from pipe unions 10 (Fig.91) located on slip ring bottom fairing 11. Blank off the pipe unions and hoses with calico cloth and cellophane.

2. Remove rubber jackets 5 (Fig.90), unlock and turn off the nuts and uncouple five plug connectors of bunched wires 6 from the receptacles mounted on the bottom fairing. Close the jointing surfaces with calico cloth and cellophane.

3. Remove top fairing 6 (Fig.91).

4. Screw off nuts 1 of terminal posts and disconnect the ends of central bunched wire 2 of the slip ring from the main gear box terminal block (Fig.92).

5. Remove two protective caps 13 of the slip ring contact brushes to provide access to bolts 14 attaching the slip ring to the butt face of the main gear box shaft (Fig.93).

6. Unlock and turn off six bolts 14 attaching the slip ring to the butt face of the main gear box shaft.

7. Unlock and turn off nuts 10, remove protective cap 9 of the central bunched wire (Fig.93) and disconnect the ends of the central bunched wire from terminals 7 (Fig.91).

8. Carefully supporting the fairing, remove the slip ring together with the bottom fairing from the helicopter.

9. Remove the blind cap from one of the pipe unions located on the bottom fairing, turn off filler cap 5 and drain off AMP-10 oil from compensating tank 3 (Fig.91).

10. Unlock and remove the union nuts of hydraulic pipes 8 from the pipe unions of the compensating tank (Fig.91). Blank off the ends of the pipes and pipe unions with calico cloth and cellophane.

11. Disconnect wire 6 running to the bottom fairing plug connectors from two contactors 7 and remove both contactors (Fig.93).

12. Unlock and turn off nuts 4 and remove contactor-attachment brackets 5 (before doing it, disconnect the clamp of drain pipe 8 from the left bracket, Fig.93).

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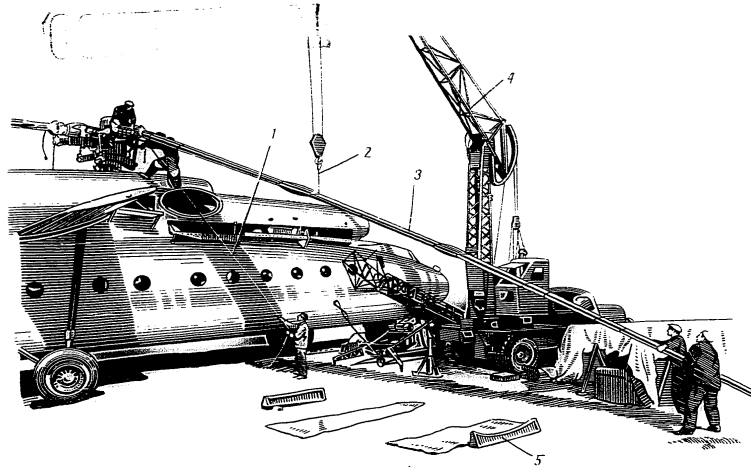


FIG. 89 REMOVING MAIN ROTOR BLADE

1 - safety sling, 2 - B9901-200 slings for lifting main rotor blade; 3 - main rotor blade; 4 - crane truck, 5 - 50-9905-600 supports.

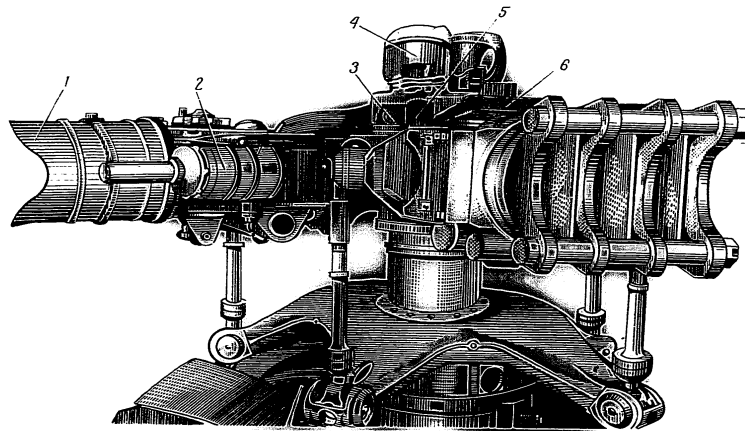


FIG. 90. MAIN ROTOR HUB WITH SLIP RING

1 - main rotor hub; 2 - hydraulic damper; 3 - hydraulic damper hoses; 4 - main rotor slip ring (without top fairing); 5 - jacket for bunched cable plug connector; 6 - bunched cable.

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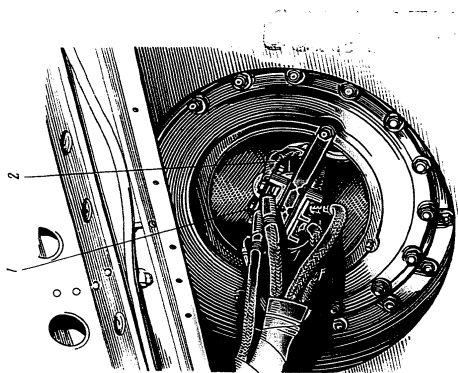


FIG. 92. CONNECTION OF SLIP RING CENTRAL BUNCH.
CABLE UNDER MAIN GEAR BOX
1 - terminal nut; 2 - slip ring central bunched cable.

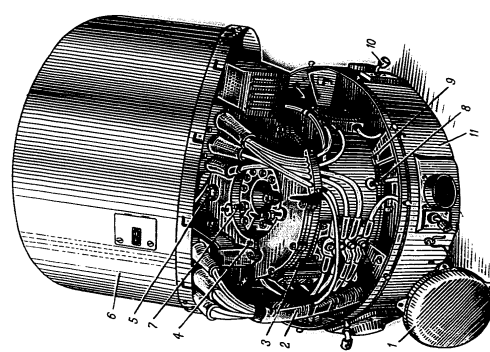


FIG. 91. MAIN ROTOR SLIP RING.
1 - protective cap of central bunched cable; 2 - bunch of contact
brushes; 3 - compensating hydraulic reservoir; 4 - nut and screw for
attaching protective cap of central bunched cable; 5 - filler cap
of compensating hydraulic reservoir; 6 - slip ring cap furring;
7 - terminals of slip ring commutator; 8 - hydraulic hose; 9 -
bolt for attaching slip ring to butt face of main gear box;
10 - pipe union of hydraulic damper hose (with plug); 11 - slip
ring bottom furring.

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13. Remove nuts 2, disconnect the wire from the four contact brushes of the slip ring; disconnect leads 12 together with terminal block 11 from the contact brush of the slip ring small rings.

14. Unlock and turn off the nuts of bolts 16 and remove two oppositely placed brackets 15 attaching the slip ring to the bottom fairing which are located under the protective caps of the slip ring brushes.

15. Remove the slip ring fairing, taking care not to damage the hydraulic piping and bunched wires.

16. Remove the vent pipe together with the pipe union from the compensating tank.

Notes: 1. After installation of the vent pipe close the hole with a dummy cap removed from the new slip ring.
2. Process the slip ring.

(2) Installation of Slip Ring

1. Deprocess a new slip ring and inspect it for mechanical damage.

2. Put the bottom fairing on the slip ring.

3. Install two brackets 15 attaching the slip ring to the bottom fairing. Tighten and lock the nuts of bolts 16 which attach the brackets to the bottom fairing (Fig.93).

4. Connect the wires to the slip ring contact brushes, tighten up nuts 2 and connect leads 12 together with block 11 to contact brushes of the slip ring small rings.

5. Install two brackets 5 intended for attachment of contactors 7 and fasten them with nuts 4. Lock the nuts.

6. Install and fix contactors 7 on brackets 5.

7. Connect leads 6 to the contactors.

8. Carefully supporting the bottom fairing, install the slip ring on the rotor hub and fasten it to the butt face of the main gear box with bolts 14.

9. Connect the central bunched wire to terminals 7 of the slip ring commutator (Fig.91).

10. Install protective cap 9 of the central bunched wire and fix it with six nuts 10 (Fig.93). Interlock the nuts with wire.

11. Connect hydraulic pipes 8 to the pipe unions of compensating tank 3 (Fig.91). Tighten up the union nuts and lock them.

12. Screw off the dummy plug from the shell of the compensating tank and install the pipe union of vent pipe 8 instead (Fig.93). Install the vent pipe. Tighten up and lock the union nut of the pipe.

13. Install and fix protective caps 13 of the slip ring contact brushes. Interlock the cap attachment screws with wire.

14. Join the ends of central bunched wire of the slip ring to the terminal block plug connector mounted under the main gear box (Fig.92) as indicated in the schematic diagram of cable connections for the slip ring terminal block of the main rotor (Fig.94).

15. Couple five connector plugs 1 of bunched wires to the receptacles of the slip ring bottom fairing (Fig.93). Tighten up and lockwire the nuts of the plug connectors.

Put jackets 5 (Fig.90) on plug connectors and retain them in place with lock wire.

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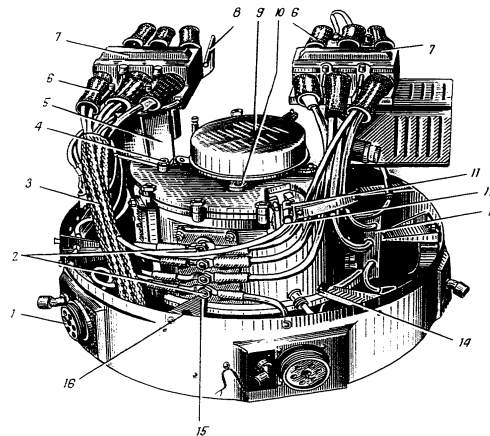


FIG. 93. MAIN ROTOR SLIP RING WITH TOP FAIRING REMOVED

1 - bunched cable plug connector; 2 - terminal nuts of slip ring brushes; 3 - bunch of contactor cables; 4 - contactor bracket attachment nut; 5 - contactor bracket; 6 - contactor leads; 7 - contactor; 8 - vent pipe; 9 - protective cap of central bunched cable; 10 - protective cap attachment nut; 11 - grip block for leads of slip ring small-ring brushes; 12 - leads of slip ring small-ring brushes; 13 - protective cap of slip ring brushes; 14 - bolt for attaching slip ring to butt face of main gear box shaft; 15 - slip ring attachment bracket; 16 - bolt for attaching bracket to slip ring bottom fairing.

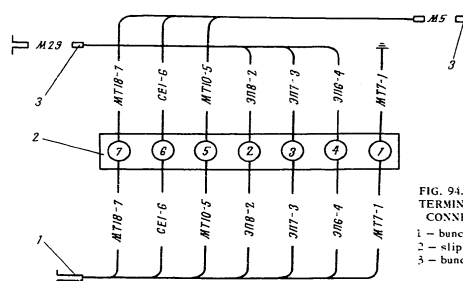


FIG. 94. MAIN ROTOR SLIP RING TERMINAL BLOCK-TO-CABLES CONNECTION DIAGRAM
1 - bunched cable from slip ring;
2 - slip ring terminal block;
3 - bunched cable to cargo compartment.

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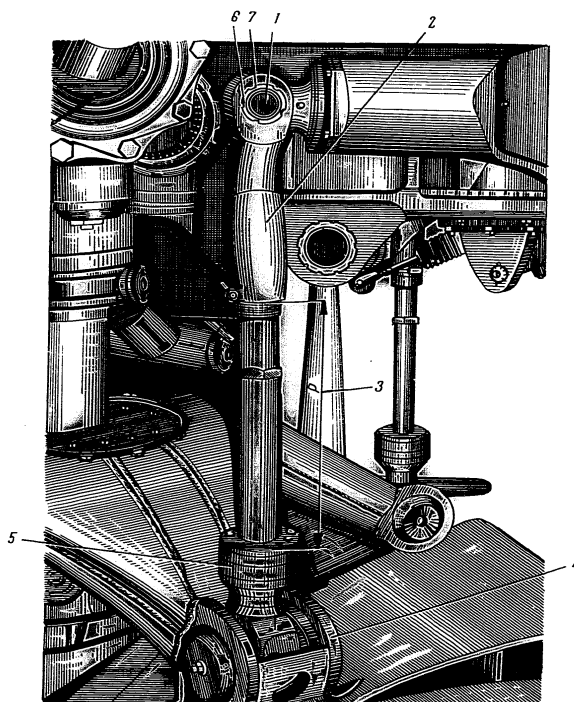


FIG. 95. INSTALLATION OF HINGED LINK-ROD
 1 - bolt for attaching swashplate hinged link-rod to main rotor hub; 2 - hinged link-rod;
 3 - hinged link-rod dimension "P" to be kept unchanged; 4 - lower attachment fitting
 of hinged link-rod; 5 - place for installation of felt gaskets; 6 - lock washer; 7 - bolt
 nut.

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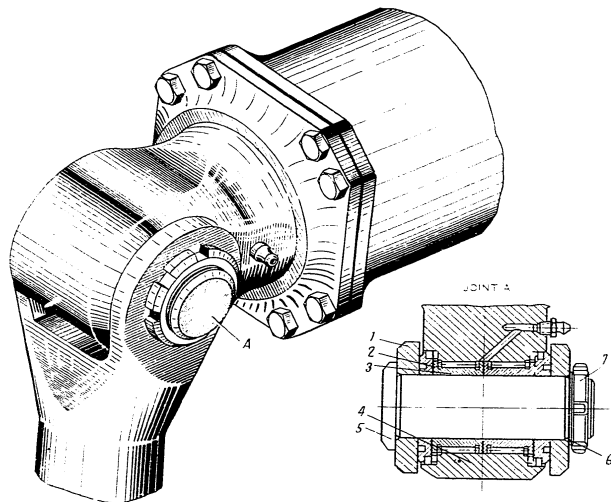


FIG. 96 JOINING WASHPATE HINGED LINK-ROD TO HINGE LIG OF MAIN ROTOR HUB
 1 - upper fork of hinged link-rod; 2 - needles; 3 - inner race of needle bearing; 4 - hinge lig of main rotor hub; 5 - pin of black anis rod; 6 - lock washer; 7 - pin nut.

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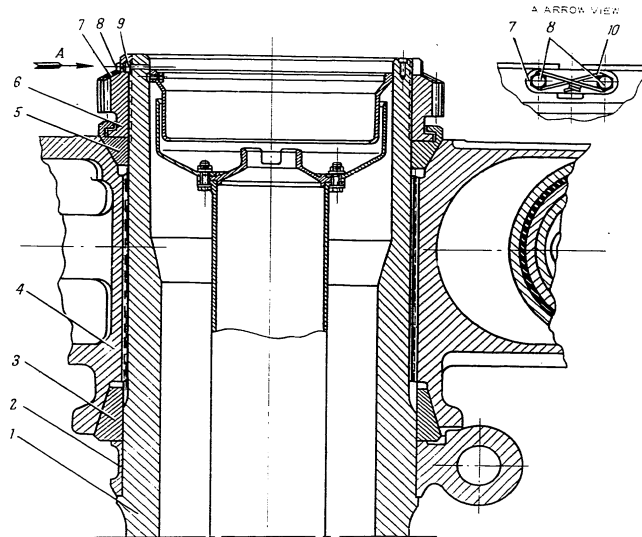


FIG. 97. SECTIONAL VIEW OF MAIN GEAR BOX SHAFT WITH MAIN ROTOR HUB INSTALLED

1 - main gear box shaft; 2 - swashplate guide ring; 3 - lower cone; 4 - main rotor hub; 5 - upper cone; 6 - nut; 7 - retainer; 8 - retainer attachment screws; 9 - lock pin; 10 - lock wire.

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16. Remove the blind caps and connect five hoses 3 of hydraulic dampers 2 (Fig.90) to pipe unions 10 located on bottom fairing 11 (Fig.91).
17. Fill the hydraulic reservoir with AMP-IO oil as specified in Section "Filling of Helicopter Hydraulic System" of the present Instructions. Make sure that there are no leaks in connections of pipes and hoses.
18. Inspect the removal and installation areas, see that there are no foreign objects or mechanical damage and make sure that all the jobs have been performed correctly.
19. Check the electrical circuits of the slip ring for continuity in compliance with feeder diagrams.
20. Install and fix the top fairing so that the mark lines on the top and bottom fairings coincide.
21. Check functioning of the heating system of the main rotor blades with the engines running.

IV. REPLACEMENT OF MAIN ROTOR HUB

(1) Removal

1. Remove the main rotor blades (see Section II of the present Chapter).
2. Remove the main rotor slip ring (see Section VII of the present Chapter).
3. Measure dimensions "F" of push-rods (Fig.95) and make sure that they conform to those recorded in the helicopter Service Log.
4. Unlock and turn off nuts 7, remove pins 5 which attach the swashplate hinged rods to shafts of hinge 4 of the main rotor hub (Figs 95, 96).

Disengage the swashplate hinged rods from the shafts of the main rotor hub hinge, exercising care not to disturb adjustment of their length. To prevent dents on the eye-lugs of the swashplate ring and the lower hinges of the hinged rods place felt gaskets 5 between them (Fig.95).

Note. To prevent damage to the hinge shaft needle bearings of the main rotor hub push-rods after disengagement of the upper forks it is recommended to tie the packs of the needle bearings to the hinge shaft with XO wire, 0.8 mm in diameter (Fig.96).

5. Unlock nut 6 attaching the main rotor hub to shaft of the main gear box (Fig.97). To do it, turn off screws 8, remove retainers 7 and drive out pins 9 (Fig.97).
6. Using the crane, lift the B9907-000 hydraulic wrench (Fig.98) and place it on the helicopter. Using the wrench, turn off nut 6 attaching the main rotor hub to the shaft of the main gear box and remove it together with cone 5 (Fig.97).
7. Install the B9715-120 appliance (Fig.99) on the upper end of the shaft so as to protect the thread of the main gear box shaft from dents.
8. Turn off five plugs for the sling eye-bolts and attach the B9901-300 slings to the main rotor hub.
9. Put the sling ring on the crane hook and smoothly, without jerks remove the main rotor hub from the main gear box shaft.
10. Lower the main rotor hub onto a support and remove lower cone 6.
11. Remove the B9901-300 slings from the old hub and install them on a new one.
12. Process the main rotor hub as specified in the "Processing and Deprocessing Instructions" issued by the Manufacturer.

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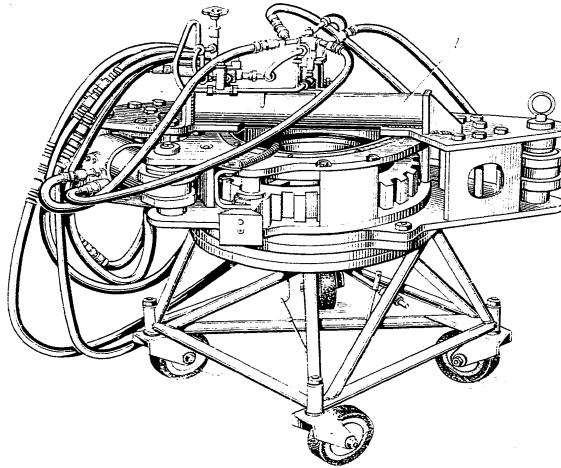


FIG. 98. HYDRAULIC WRENCH
1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

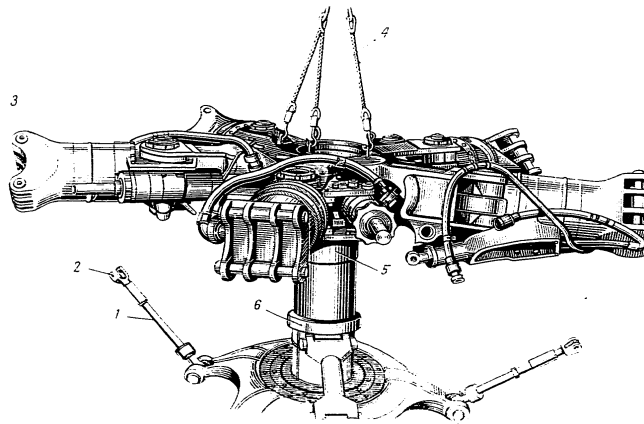


FIG. 99. SUPPORTING MAIN ROTOR HUB BY STINGS

1. vertical hinged link; 2. supporting of hinge link; 3. main rotor hub; 4. 10000-500 stings for supporting; 5. 10000-500 stings for supporting; 6. 10000-500 stings for supporting.

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(2) Installation

1. Wipe the splines of the main gear box shaft and inspect them visually for mechanical damage.
2. Deprocess the main rotor hub.
3. Apply HK-50 grease to the splines of the main rotor hub and the main gear box shaft as well as cones 3, 5, the thread and face of nut 6 (Fig.97).
4. Put lower cone 3 on shaft 1 of the main gear box.
5. Using the crane, lift the main rotor hub and position it so that the filler plug coincides with the axis of one of the holes located on the butt face of the main gear box shaft and then smoothly place the hub on the shaft splines. The hub should seat on cone 3; the lug of the swashplate guide ring 2 should enter the slot of the main rotor hub.
6. Remove slings 4 from the main rotor hub and appliance 5 from the main gear box shaft (Fig.99).
7. Install upper cone 5 in assembly with nut 6 on the main gear box shaft (Fig.97).
8. Using the B9907-000 hydraulic wrench, tighten up nut 6 with $M_{torque} = 3000 \text{ kg-m}$ which corresponds to $P = 75-80 \text{ kg/sq cm}$ as indicated by the pressure gauge.
9. Lock nut 6 with pin 9 and retainers 7. Fix the retainers with screws 8. Fasten the screws to each other with KO-K-1.0 lock wire.
10. Make sure that dimensions "P" of the hinged rods conform to those recorded in the helicopter Service Log. Remove felt gaskets from the lower hinges of the vertical rods and connect the hinged rods to the shaft of the main rotor hub hinge. Install hinged rod pins 5, place lock washers 6, install nuts 7 and tighten them up with $M_{torque} = 15-20 \text{ kg-m}$. The tightening over, retain the nuts by bending the tab of the lock washer so that it gets into the adjacent slot of the nut (Figs 95, 96).
11. Check adjustment of the main rotor control system as specified in Section "Adjustment of Main Rotor Control System".
12. Install the slip ring and connect the electrical wires to it (see Section III of the present Chapter).
13. Install the blades of the main rotor (see Section II of the present Chapter).
14. Inspect the installation area, see that there are no foreign objects around and make sure that all parts are properly installed and looked.

Note. If the paint coating on the parts of the main rotor hub is damaged, the defective surfaces should be re-painted as specified in the present Instructions in Section on care of the main rotor hub.

V. REPLACEMENT OF SWASHPLATE

(1) Removal

1. Disassemble and remove the main rotor blades (see Section II of the present Chapter).
2. Disassemble and remove the slip ring from the helicopter (see Section III of the present Chapter).
3. Measure dimension "P" of hinged rods (Fig.95) and make sure that they conform to those recorded in the helicopter Service Log.
4. Disconnect and remove the main rotor hub from the helicopter (see Section IV of the present Chapter).

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5. Remove gear box compartment cowl 12 (Fig.75).
6. Disengage power link-rods 9 connected to the lateral and longitudinal control hydraulic boosters (Fig.101) from the swashplate lateral and longitudinal control link-rods. To achieve it, unlock and turn off the pin nuts and drive out pins 10.
- CAUTION. When driving out the pins, take care not to damage plugs screwed into the threaded sockets of the pins.
7. Disengage shackle 4 of the collective pitch hydraulic booster (Fig.102) from the swashplate collective pitch lever. To effect this, unlock and remove pin nut and drive out the pin.
8. Disengage the support of the swashplate collective pitch lever from hydraulic booster bracket 1. To this end, unlock and remove nut 4 and drive out pin 3. (Fig.103).
9. Remove cotter pins and screw off nuts 4 which attach plate 3 of the swashplate slide guide to the main gear box.
10. Screw the eye-bolts of slings 5 into the threaded holes of plate 3 and put the sling ring on the crane hook.
11. Install appliance 6 on the threaded portion of the main gear box to protect thread (Fig.104).
- Note. Before removing the swashplate from the main gear box, install the 83745-120 appliance for attachment of the ring and the guide arm and protection of these components from dents. (The appliance is shipped by the swashplate Manufacturer in one shipping container together with the swashplate).
12. Using the crane lift the swashplate, strike guide ring 1 (Fig.104) with a mallet until it completely comes off the main gear box shaft and remove the swashplate from the main gear box shaft.
13. Lower the swashplate onto supports and disengage the slings.
14. Process the removed swashplate as specified in the Manufacturer's Instructions.

(2) Installation

1. Open the container with a new swashplate. Take off the PVC jacket from the swashplate and remove the wrapping paper. Using a piece of cloth soaked with gasoline remove the rust-preventive grease from the swashplate.
2. Inspect the swashplate and make sure that it is free from dents or other mechanical damage.
3. Make sure that the swashplate number indicated in the Certificate is similar to that branded on the swashplate, check the date of processing and the guaranteed period.
4. Place felt gaskets 5 between the fittings of the lower forks of the swashplate link-rods and the eye-lugs of the ring (Fig.95).
5. Inspect the shaft of the P-7 gear box and the seating surfaces on the gear box, make sure that there is no mechanical damage and coat the shaft splines with HK-50 grease.
6. Screw the threaded end lugs of the slings into the holes of the slide guide plate of the swashplate and put the ring of the slings on the crane hook.
- Note. Before installing the swashplate on the main gear box, make sure that it is fitted with the 75-T346 appliance which protects the ring and the guide from dents during installation of the swashplate.

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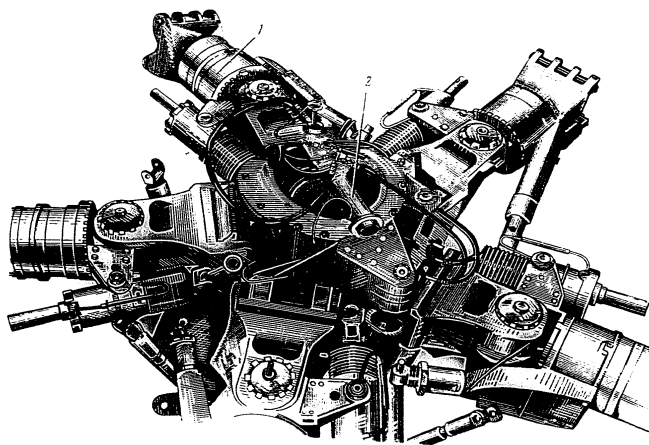


FIG. 100. MOUNTING B9 907-000 HYDRAULIC WRENCH ON MAIN ROTOR HUB
1 - main rotor hub; 2 - B9 907-000 hydraulic wrench.

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COLLECTIVE PITCH

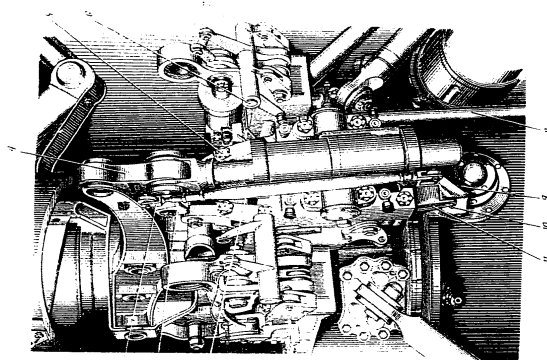


FIG. 102. INSTALLATION OF COLLECTIVE PITCH CONTROL HYDRAULIC BOOSTER

1 - collective pitch control link-rod; 2 - bolt for connecting link-rod to bell crank of hydraulic booster slide; 3 - hydraulic booster slide bell crank; 4 - hydraulic booster shackle; 5 - nut for attaching hydraulic booster to plate; 6 - bolt for attaching control bell crank to hydraulic booster body; 7 - control bell crank; 8 - control link-rod; 9 - bell crank; 10 - bell crank pivot pin; 11 - bracket.

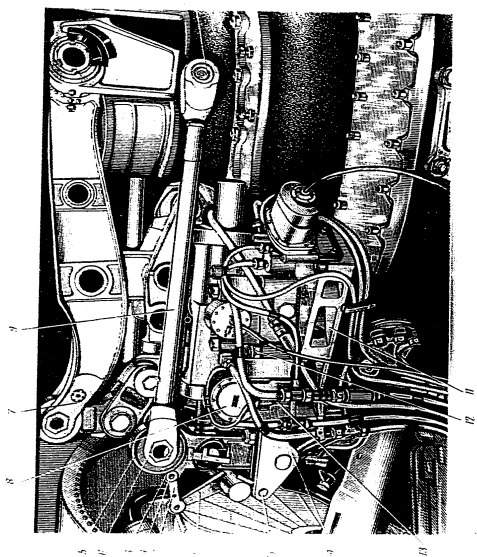


FIG. 101. INSTALLATION OF HY-35A HYDRAULIC BOOSTER

1 - control bell crank; 2 - forked link rod for connecting bell crank of hydraulic booster slide to control bell crank; 3 - bell crank of hydraulic booster slide; 4 - bolt for attaching forked link-rod to bell crank of hydraulic booster slide; 5 - actuating bell crank of hydraulic booster; 6 - pin for connecting actuating bell crank to power rod; 7 - arm of collective pitch control; 8 - /OC- 800 transmitter; 9 - power rod; 10 - pin for connecting power rod to swashplate arm; 11 - hydraulic booster plate; 12 - nut for attaching hydraulic booster to plate; 13 - plug connector of /OC- 800 transmitter bunched cable; 14 - HY-35A hydraulic booster; 15 - bolt for attaching control bell crank to hydraulic booster body.

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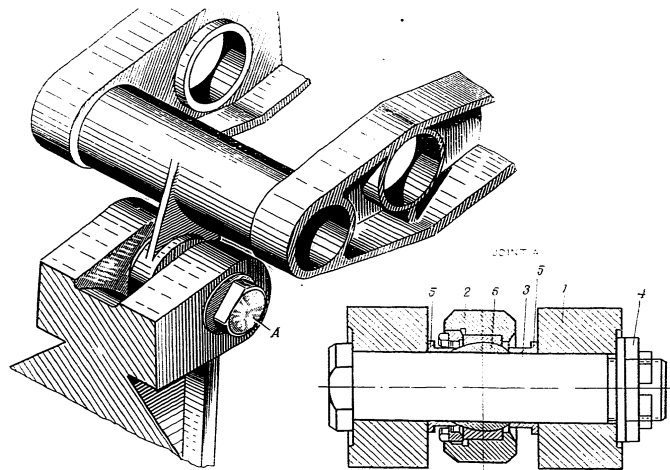


FIG. 103. JOINING HYDRAULIC BOOSTER BRACKET TO SHACKLE HINGE LUG OF SWASHPLATE COLLECTIVE-PITCH ARM
1 - hydraulic booster bracket; 2 - shackle hinge lug of swashplate collective-pitch arm; 3 - pin; 4 - pin nut; 5 - spacer sleeves; 6 - ball bearing.

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(The 75-F346 appliance is shipped by the Manufacturer in one shipping container together with the swashplate).

7. Using the crane lift the swashplate, wipe the lower flange of the slide plate with a piece of cloth and install the swashplate on the seating platform of the P-7 main gear box trying to match the holes in plate 3 with the gear box studs.

Install the guide ring on the gear box shaft, slowly lower the swashplate and like the guide ring with gentle strokes of the mallet until it bears against the lar of the gear box shaft.

Note. During installation of the swashplate on the main gear box studs (when the swashplate is still suspended) it is necessary to screw two nuts on the studs located on the front section (as viewed from the helicopter tail) of the swashplate slide guide (on the fittings of the collective pitch lever). Then gradually lower the swashplate and tighten up the above indicated nuts.

8. Remove the slings from the swashplate, turn off the threaded end-fittings on the base plate of the swashplate slide guide.

9. Screw nuts 4 on the gear box studs, tighten them up with a torque wrench torque = 20-25 kg-m) and lock with cotter pins, 3x30.

10. Engage the longitudinal and lateral control bell cranks of the swashplate with power link-rods 9 (Fig.101). To effect this, install pins 10, place the lock washers and tighten up the nuts of the pins. Lock the nuts by bending the washer tabs into the adjacent slots of the nut.

11. Connect shackle 4 of the collective pitch hydraulic booster (Fig.102) with the collective pitch lever of the swashplate. To this end, install pin, place the lock washer, tighten up the pin nut and lock the nut by bending the washer tab into the adjacent slot of the nut.

12. Engage support of the collective pitch lever with hydraulic booster bracket 1. To effect this, install pin 3, place two spacer sleeves 5 between the side webs of the bracket and the inner race of the NM-35 bearing, tighten up nut 4 and lock it with a cotter pin, 3x60 (Fig.103).

13. Install the main rotor hub (see Section IV of the present Chapter).

14. Adjust the length of hinge link-rods (Fig.95) so that dimension "P" conforms to those recorded in the Service Log of the main rotor blades.

15. Remove the felt gaskets from the lower fittings of the hinged link-rods and connect the hinged link-rods to the shafts of the main rotor hub hinge. Place lock washers 6 under nuts 7 of the pins. Tighten up the nuts with a torque wrench (torque = 15-20 kg-m) and lock them in place by bending the lock washer tab into the adjacent slot of the nut (Fig.96).

16. Install cowl 12 of the gear box compartment (Fig.75).

17. Check adjustment of the longitudinal, lateral and collective pitch-throttle control systems as specified in Section "Adjustment of Control Systems".

18. Install the slip ring (see Section III of the present Chapter).

19. Attach the main rotor blades (see Section II of the present Chapter).

20. Inspect the installation area, see that there are no foreign objects, mechanical damage and make sure that the installation job has been performed correctly.

21. Check the main rotor blades for proper tracking as specified in Chapter VI, Part II of the present Instructions.

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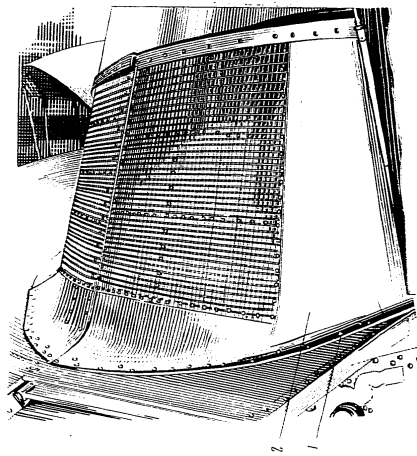


FIG. 105. RING WITH 11 ring attachment screws; 1 - main shaft with filler

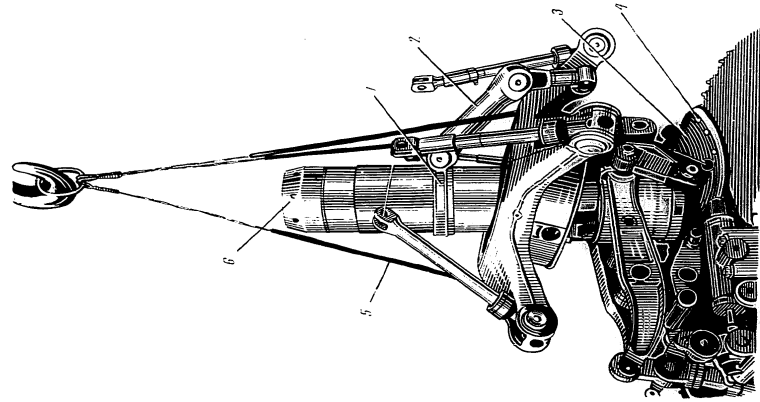


FIG. 103. INSTALLING SWASHPLATE ON MAIN GEAR BOX. 1 - swashplate guide ring; 2 - swashplate guide; 3 - plate for attaching swashplate to main gear box; 4 - nuts for attaching plate; 5 - main gear box studs; 6 - 6.817 106 studs for lifting swashplate; 6 - 107-15 120 applied for protecting thread on main gear box shaft.

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VI. REPLACEMENT OF P-7 MAIN GEAR BOX

Before replacement of the main gear box lock the control tail cranks located on fuselage frame 14 in neutral position.

(1) Removal

1. Drain oil from the main gear box oil system.
2. Disassemble and remove the main rotor blades (see Section II of the present Chapter).
3. Dismantle the slip ring and remove it from the helicopter (see Section III of the present Chapter).
4. Disengage the hinged link-rods of the swashplate from the main rotor hub, dismantle and remove the main rotor hub (see Section IV of the present Chapter).
5. Remove all clamps and brackets attaching the piping and bunched conductors from the structural elements of the cowl: tail cowl 4, gear box cowl 12, fan cowls 7, 8, 9 and central cowl 23.
6. Dismantle and remove the tail, gear box, fan and central cowls from the helicopter.
7. Turn off screws 1 and remove nose section 2 of the wing fillet (Fig.105).
8. Dismantle and remove shield 1 of the fan compartment cowls from the helicopter (Fig.76).
9. Remove the engine exhaust pipes and transmission shafts (see Section I of the present Chapter).
10. Remove the cardan shaft of the fan drive (see Section X of the present Chapter).
11. Disconnect stabilizer control wire rope 5 from sector 6 (Fig.106) and the control wire rope of the main rotor brake from the brake lever.
12. Unlock and remove nuts 2 and 4 attaching coupling 3 to the flanges of the main gear box shaft shank and the tail transmission shaft (Fig.106). Remove the coupling bolts.
13. Disconnect hoses, piping of the hydraulic system and air trunks from the HM-21 hydraulic pumps. Blank off the ends of pipe unions, trunks and piping with blind caps.
14. Remove protective covers 3 from the A.C. generators, disconnect electric bunched conductors 1 (Fig.107) and install the protective covers in place. Slacken the clamps, disconnect the air cooling pipes from the air trunks of the generators and the fan unit and remove the piping from the helicopter.
15. Disconnect the hydraulic piping and link-rods from the hydraulic boosters of the lateral, longitudinal and collective pitch control systems (the power link-rods should not be removed).
16. Disconnect plug connectors from the AV-33 and HOC-800 units and from the П-1, CT-1, DT3-2, CAV-5, ИЛ-8 transmitters on the main gear box.
17. Disconnect the clamps and brackets attaching the electrical bunched conductors and piping of the hydraulic, oil and air cooling systems from the braces of the gear box mount. Remove the oil pipe attached to the pipe unions and connections of the main gear box. Blank off the open ends of the pipe-line pipe unions with blind caps and remove the oil pipe-line from the helicopter. Roll the bunched conductors in reels, wrap up with cellophane and stow in the gear box compartment to protect them from damage.

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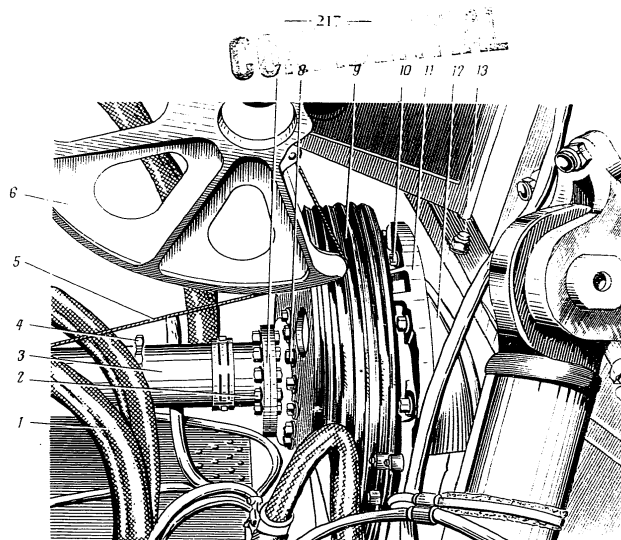


FIG. 106. MAIN ROTOR BRAKE

1 - hydraulic pump hose; 2 - nut for attaching flange coupling to flange of main gear box shank; 3 - flange coupling; 4 - nut for attaching flange coupling to flange of tail transmission shaft; 5 - stabilizer control wire rope; 6 - sector; 7 - flange of main gear box shank; 8 - brake drum attachment bolt; 9 - brake drum; 10 - nut for attaching brake support to main gear box pump; 11 - brake support; 12 - main gear box pump; 13 - bracket for attaching sector 6 to main gear box housing.

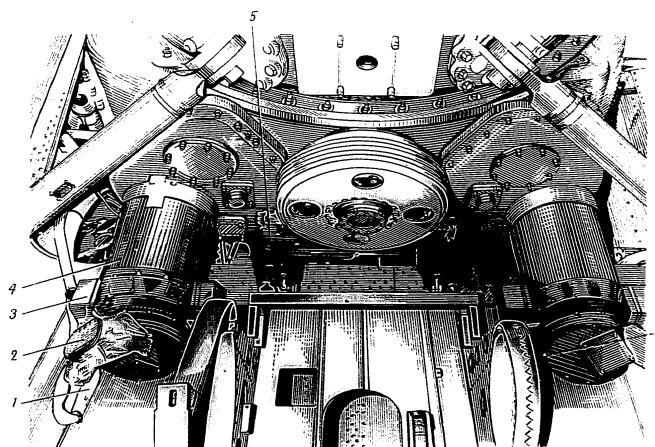


FIG. 107. INSTALLATION OF CTC-90/260 GENERATOR

1 - bunched cable to generator; 2 - air trunk for generator cooling; 3 - terminal box cover; 4 - generator; 5 - 662 hydraulic pump; 6 - attachment bolt of air trunk.

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18. Inspect the main gear box and make sure that all piping, link-rods and electric bunched conductors are disconnected from the gear box and its components and nothing interferes with removal of the gear box from the helicopter.
19. Using a crane lift eye-nut 5 and screw it on the main gear box shaft (Fig.108).
20. Remove cotter pins and turn off the nuts from all jointing bolts 3.
21. Drive out two jointing bolts attaching front braces 2 to the fuselage fittings supporting the gear box by the eye-nut with the crane.
22. Lift the main gear box until two front braces get out of the fuselage fittings.
23. Drive out the two jointing bolts attaching the rear braces to the fuselage fittings.
24. Carefully lift the main gear box with the crane until the forks of rear braces get out of the fuselage fittings, then lift it somewhat higher and lower on the supports placed at one side of the helicopter.
25. Turn off and remove the eye-nut from the main gear box shaft.
26. Remove cotter pins and turn off nuts 8 of bolts 9 (Fig.109).
27. Supporting brace 10 drive out two bolts 9, withdraw the brace from brackets 4 and place it on wooden boarding.
28. Remove three other braces, one after another.
29. Number brackets 4 with paint and after removal of the old gear box inscribe the respective numbers on the housing of the new gear box.
30. Remove cotter pins and turn off nuts 7 which attach brackets 4 on the main gear box studs.
- Remove the brackets and place them on a bench for storage.
31. Remove sector 6 together with bracket 13 (Fig.106).
32. Remove the EV-33A hydraulic boosters of the longitudinal and lateral control systems (see Section XIV of the present Chapter).
33. Remove the EV-32A hydraulic booster of the collective pitch system (see Section XIII of the present Chapter).
34. Remove the AV-33 unit, plates 3, 1 attaching the EV-32A, EV-33A hydraulic boosters and supports 2 (Fig.109).
35. Dismantle and remove the swashplate from the main gear box shaft (see Section V).
36. Mark the position of rotors and stators of both CFC-90/360 generators with paint (so that they are in phase when installed on the new gear box) and remove the CFC-90/360 A.C. generators (see Section XII).
37. Remove the H-I, CT-I, MTB-2, CHV-5 and MM-8 transmitters (see Figs 109, 110, 111).
- Close the seating surfaces for the transmitters with dummy caps removed from the new gear box.
38. Remove the HM-2C hydraulic pumps.
39. Remove the main rotor brake (see Section VII of the present Chapter).
40. Remove the filler necks of the main gear box oil system.
41. Process the removed gear box as specified in the Operating and Maintenance Instructions on P-7 Gearbox Installed on the MM-6 Helicopter.

(2) Preliminary Assembly of Main Gear Box

1. Deprocess the exterior of the new gear box.

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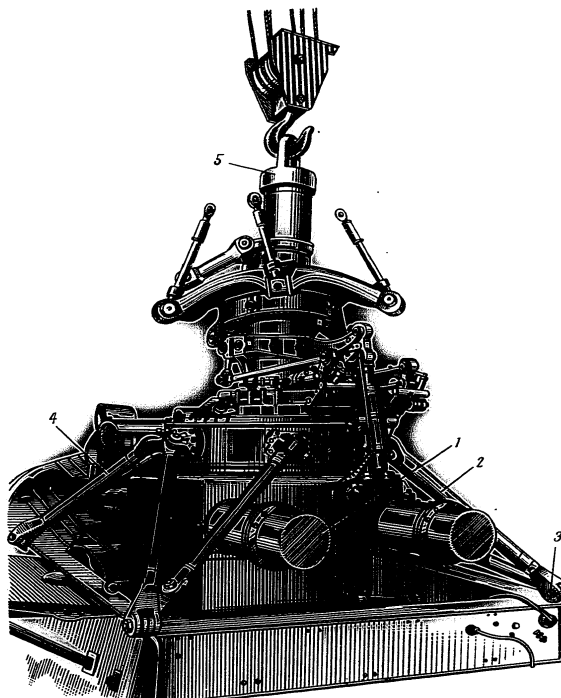


FIG. 108. JOINTING P-7 MAIN GEAR BOX TO FUSELAGE
1 - dummy cap to main gear box roller coupling; 2 - front braces of gear box mount; 3 - jointing bolts for attachment of gear box mount to fuselage fittings; 4 - rear braces of gear box mount;
5 - B9715-030 eye-nut.

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2. Wipe dry the jointing fittings on the braces and fuselage of the helicopter. Inspect them for mechanical damage, dents and scoring. Check diameter 45A of the holes as well as finishing of the hole surfaces which should be V 6 on the fuselage fittings and V 7 on the gear box mount fittings.
3. Install the filler necks of the oil system on the main gear box housing.
4. Install the main rotor brake (see Section VII of the present Chapter).
5. Install the HM-2C hydraulic pumps.
6. Install the H-I, CT-I, HTG-2, CHV-5 and MM-8 transmitters.
7. Install the CFC-90/360 A.C. generators (see Section XII of the present Chapter), so that they are kept in phase. When doing so, hold the shafts of the generators and the gear box from rotation until both generators are completely installed. The mark lines on the shafts of the rotors and stators of the generators should coincide.
8. Install the swashplate on the main gear box (see Section V, Items 2-6 of the present Chapter).
9. Install supports 2 on the studs of the main gear box, screw up the nuts and tighten them up with a torque wrench ($M_{\text{torque}} = 7-8 \text{ kg-m}$). Lock the nuts with cotter pins (Fig.109).
10. Install booster plate 1 on supports 2 so that the plate fork is engaged with the swashplate lever and place spacer washers between the fork and the lever. Install bolts, screw up and tighten the attachment nuts. Lock the nuts with cotter pins.
11. Install the EV-33A booster plates of the longitudinal and lateral control systems on the studs of the main gear box and the bosses of the EV-32A booster plate.
12. Put the nuts on the studs of the booster plates, tighten them up with a torque wrench ($M_{\text{torque}} = 13-14 \text{ kg-m}$) and lock with cotter pins. Install and fix the AY-33 unit of the longitudinal and lateral control systems.
13. Install the EV-32A hydraulic booster on the booster plate studs (see Section XIII, Items 3, 4 of the present Chapter).
14. Install the EV-33A hydraulic boosters on the studs of the booster plates of the longitudinal and lateral control systems (see Section XIV, Items 5 and 6 of the present Chapter).
15. Install bracket 13 together with sector 6 on the main gear box (Fig.106). Put the nuts on the bracket attachment studs. Tighten up and cotter-pin the nuts. Attach the link-rod of the swashplate slide to the sector arm.
16. Install brackets 4 (Fig.109) on the gear box studs according to the marks made during their removal. Before doing it, check the bracket flanges for proper seating to the attachment surfaces of the gear box. (The clearance should not exceed 0.05 mm). Before installation of the brackets coat the attachment surfaces of the brackets and the gear box with gun grease or HMATM-20I grease.
- Screw up nuts 7 and tighten them up with a torque wrench ($M_{\text{torque}} = 20-25 \text{ kg-m}$). Lock the nuts with cotter pins, 3x60 mm.
17. Fit the front and rear braces of the gear box mount in brackets 4 (one after another), coat bolts 9 with HMATM-20I grease and install the bolts in the matched holes of the braces and brackets. Screw nuts 8 and tighten them up with a torque wrench ($M_{\text{torque}} = 40 \text{ kg-m}$). Lock the nuts with cotter pins 4x70 mm.
18. Lift the eye nut by means of a crane and install it on the main gear box shaft.

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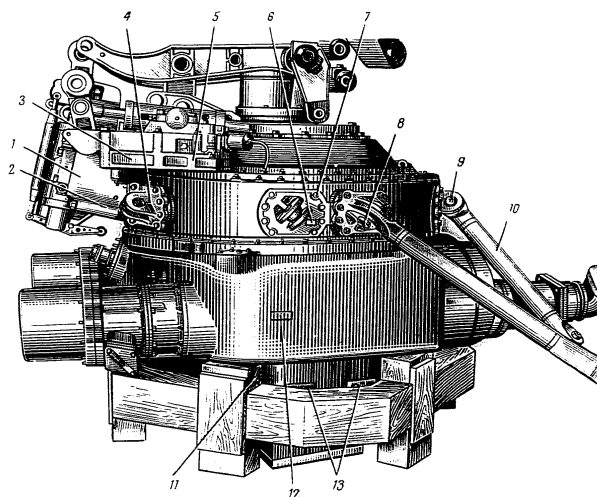


FIG. 109. ATTACHMENT OF GEAR BOX BRACES TO MAIN GEAR BOX

1 - plate of collective pitch hydraulic booster; 2 - support for attachment of plate 1; 3 - plate of lateral (longitudinal) control hydraulic booster; 4 - gear box attachment bracket; 5 - nut for attaching plate to main gear box studs; 6 - place for marking serial number of bracket; 7 - nut for attaching bracket 4 to main gear box studs; 8 - bolt attachment nut; 9 - bolt for attaching gear box mount to main gear box brackets; 10 - gear box mount brace; 11 - supports for mounting main gear box; 12 - place for marking serial number of brackets 4 on main gear box housing; 13 - 11-1 transmitter.

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(3) Installation of Main Gear Box

1. Using a crane lift the main gear box and place it at the installation area on the fuselage.
 2. Coat the fittings of the gear box mount and the fuselage with UMATYM-20I grease.
 3. Carefully lower the gear box so that the rear braces rest upon the fuselage fittings, joint the fittings of the rear braces to the fuselage fittings located at the right and left sides and fix them in place with pins, dia. $45^{+0.05}_{-0}$ mm (Fig.108).
 4. Carefully lower the gear box and direct the front braces so that their eye-lugs approach the front fittings of the fuselage until the holes completely coincide first on one side and then on the other (Fig.108). Install dummy pins, dia. $45^{+0.05}_{-0}$ mm.
 5. Coat jointing bolts 3 with UMATYM-20I grease, fit them with special threaded guides which protect the thread from dents and ensure correct movement of the bolt into the holes of the brace and the fitting.
Remove the dummy pins, replacing them by the jointing bolts.
Remove the threaded guides and install nuts. Tighten up the nuts with a torque wrench ($M_{torque} = 40^{+10}_{-10}$ kg-m) and lock them with cotter pins, 4x70.
 6. Turn off the eye-nut and remove it from the main gear box shaft. Place the helicopter by the reference points so that it is in the flight line and check the setting angle of the main gear box shaft which should be equal to 5^{+5}_{-5} in the longitudinal plane and 0^{+5}_{-5} in the lateral plane.
 7. Route the electric bunched conductors, the pipe-lines of the hydraulic, oil and air cooling systems along the braces of the gear box mount and fix them in place. Install the air cooling devices of the GFC-90/360 A.C. generators and oil pipes disconnected during the removal procedure.
 8. Attach the plug connectors to the AY-33, ROC-800 units, GFC-90/260 A.C. generators and the H-I, CT-I, MT3-2, GAV-5, ML-8 transmitters.
 9. Remove the dummy blind caps from the pipe unions of the AY-33, EV-32A, EV-33A units and hydraulic pipe-lines. Connect the hydraulic piping to the AY-33 unit and the hydraulic boosters of the lateral, longitudinal, and the collective pitch control systems. Connect the control link rods to the EV-32A and EV-33A units (see Section XIV, Item 5 and Section XIII, Item 7).
 10. Remove the dummy blind caps from the pipe unions of the hydraulic pumps and pipe-line and connect the hoses, hydraulic system pipes and air trunks to the HM-20 hydraulic pumps.
 11. Join flange coupling 3 (Fig.106) to the flange of the tail transmission shaft, install the attachment bolts, screw up the nuts and tighten them up with a torque wrench ($M_{torque} = 3-3.5$ kg-m). Lock the nuts with cotter pins, 2.3x30.
- Notes: 1. During installation of the bolts see that only balancing bolts with figure "1" branded on their heads are fitted into the flange holes branded with figure "1" and the balancing bolts marked with figures "2" and "3", into holes marked "2" and "3", respectively. Normal (non balancing) bolts should be installed in the nonbranded holes.
2. Joint the flange of the tail shaft to the fixed flange of the coupling.
 12. Connect stabilizer control wire rope 5 (Fig.106) to sector 6 and the main rotor brake control wire rope to the brake lever. With the brake shoes in the braked position tighten the control wire rope with an effort of 180^{+10}_{-10} kg.

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13. Check adjustment of the main rotor brake control system as specified in Section VII "Adjustment of Main Rotor Brake".

14. Check alignment between the main gear box shank and the fan drive (Section I of the present Chapter).

15. Install the assembly of the fan drive cardan shaft (see Section X).

16. Turn the transmission shaft with wrench 3 (Fig.120) and check the first section of the tail shaft near the rotor brake for run-out by means of appliance 2 and indicator 1 (Fig.121). The run-out is allowed within 0.4 mm.

Note. If the run-out exceeds the allowable limits it is necessary to turn the shaft with respect to the flanged joint and re-install it.

17. Check alignment of the engines relative to the main gear box as specified in Section I of the present Chapter.

18. Install the exhaust pipes and engine transmissions (see Section I).

19. Install the screen of the fan compartment cowl.

20. Mount rear cowl 14, gear box compartment cowl 12, fan compartment cowls 7, 8, 9, and central compartment cowl 23 (Fig.75).

21. Install the piping and electrical equipment located on the structural elements of the installed cowls.

22. Install the nose section of the wing fillet.

23. Mount the main rotor hub.

24. Energize the helicopter electrical equipment (from the airfield power supply) and check it for proper functioning.

25. Make sure that all connections are leak-proof and check functioning of the main and duplicating hydraulic systems from the airfield hydraulic unit.

26. Check adjustment of the longitudinal, lateral, and collective pitch-throttle control systems in keeping with the instructions contained in Chapter V "Adjustment of Helicopter Flight Controls".

27. Check engagement of the duplicating system with the imitation of binding in controls of the EV-33A and EV-33A hydraulic boosters.

28. Check the tension of the stabilizer control wire ropes which should be 65-85 kg. Check the deflection angles of the stabilizer which should correspond to the values indicated in Chapter V, Part II.

29. Install the main rotor slip ring (see Section III).

30. Attach the blades of the main rotor (see Section II).

31. Inspect the installation area, see that there are no foreign objects, mechanical damage and make sure that the installation has been performed correctly.

32. Deprocess the interior of the main gear box as specified in "Operating and Maintenance Instruction on P-7 Gear Box Installed on Mx-6 Helicopter".

33. Fill the main gear box oil system with oil as specified in Chapter "Servicing Helicopter Systems" of the present Instructions.

34. After the first flight check tightening of nuts 7 (Fig.109) attaching brackets 4 by means of a torque wrench ($M_{\text{torque}} = 20-25 \text{ kg-m}$).

VII. REPLACEMENT OF MAIN ROTOR BRAKE

(1) Removal

1. Open the side rear covers of the gear box compartment cowl (Fig.75).

2. Disengage flange coupling 3 from the flange of main gear box shank 7 and from the flange of the tail shaft extension piece by removing twelve bolts with nuts 4 and 2 in each joint (Fig.106).

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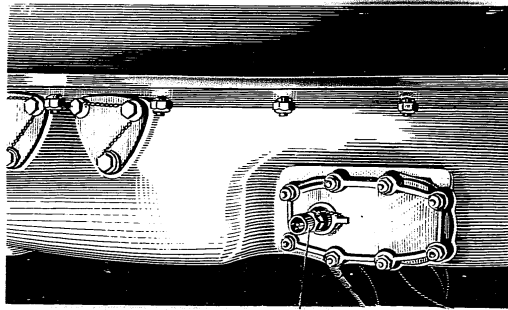


FIG. 110. MOUNTING 11-1 TRANSMITTER ON MAIN GEAR BOX HOUSING
1 - 11-1 transmitter.

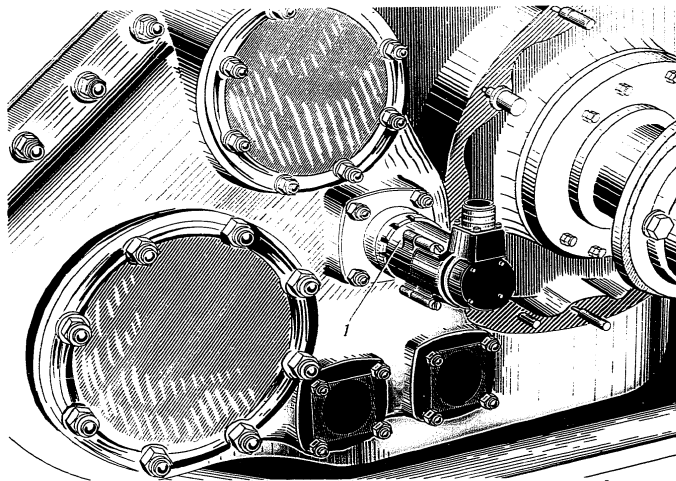


FIG. 111. MOUNTING 11-2 TRANSMITTER ON MAIN GEAR BOX HOUSING
1 - 11-2 transmitter.

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3. Remove two HM-20 hydraulic pumps (placed close to the brake drum of the main rotor), disconnect the piping and plug the pipe ends.
4. Unlock and turn off bolts 8 attaching drum 9 of the brake to the flange of main gear box shank 7.
5. Release the main rotor brake by setting the brake control lever in the extreme low position and remove drum 9.
6. Disconnect the control wire rope from the brake lever.
7. Unlock and turn off nuts 10 attaching support 11 of the brake to main gear box sump 12.
8. Remove the support from the gear box case.

(2) Installation

1. Mount support 11 of the main rotor brake on main gear box sump 12, put washers and nuts 10 on the studs and tighten up the nuts with a torque wrench ($M_{\text{torque}} = 5-6 \text{ kg-m}$). Lock the nuts with cotter pins, 2.5x30.
2. Install brake drum 9 on flange 7 of the main gear box shank, screw in and tighten up bolts 8 with a torque wrench ($M_{\text{torque}} = 9-10 \text{ kg-m}$). Lock the bolt heads in pairs with K0-K1.5 wire.
3. Turn adjusting screws of the brake shoes to set a 0.2-0.3 mm clearance between the brake shoes and the drum. Using the spacer screw of the brake arm adjust the clearance between the flat surfaces of the cam and the bearing surface of the arms as required. The clearance is checked by the play of the brake control lever in the support plane which should be 0.5-3.5 mm at a 200-mm length of the lever (i.e. in the point of connection of the brake control wire rope to the lever, Fig.40).
4. Connect the brake wire rope to the brake control lever and check once more the minimum clearance between the brake shoes and the drum when they are released.
5. Mount two HM-20 hydraulic pumps removed earlier from the helicopter and connect the piping.
6. Joint flange coupling 3 to the flange of the main gear box shank and the flange of the tail shaft extension piece, install the attachments bolts (the bolts should be installed in compliance with the branded figures - see Note for Item 4, Section IX of the present Chapter) and screw up nuts 2 and 4. Tighten up the nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins measuring 2.5x30.
7. Inspect the installation area, see that there is no mechanical damage or foreign objects and make sure that the parts are correctly installed and reliably locked.
8. Close the side rear covers of the gear box compartment.
9. Check functioning of the main rotor brake control system.
With the brake released the wire rope should have a slight sag and with the brake applied the tension of the wire rope should be 65-85 kg.
10. Check the hoses and pipes in connections to the HM-20 hydraulic pumps for leakage with the engines running.

VIII. REPLACEMENT OF INTERMEDIATE GEAR BOX

(1) Removal

1. Remove cotter pins and turn off the nut of bolt 4 jointing shock absorber strut 3 to tail bumper frame 5 (Fig.112).

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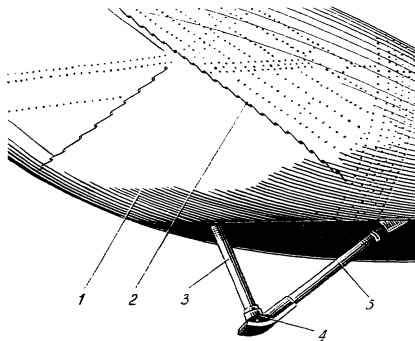


FIG. 112. TAIL BUMPER AND TAIL BOOM LOWER FAIRING
1 - lower fairing; 2 - lower fairing attachment screws; 3 - tail bumper shock absorber; 4 - tail bumper bolt; 5 - tail bumper frame.

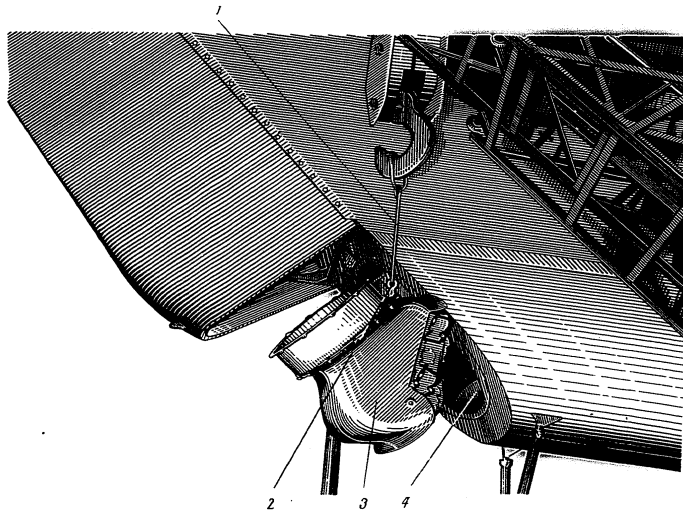


FIG. 113. REMOVING INTERMEDIATE GEAR BOX
1 - B9901-250 slings; 2 - eye-bolt; 3 - intermediate gear box; 4 - access panel of intermediate gear box.

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2. Withdraw the bolt and disengage the shock strut from the frame.
 3. Unlock and turn off screws 2 attaching the lower fairing and remove the latter from the helicopter.
 4. Turn off the screws and remove access panel 4 (Fig.113).
 5. Unlock and turn off screws 3, disconnect baffle wall 2 from the intermediate gear box (Fig.114). Turn off the screws attaching the baffle wall to the fin beam and the screws attaching the reinforcing frame of the baffle wall to the fin beam. Remove the baffle wall together with the reinforcing frame from the helicopter.
 6. Unlock and remove the union nuts of the plug connectors from the П10-3, CT-1 and П-1 transmitters of the intermediate gear box (Fig.115).
 7. Remove cotter pins and turn off the nuts of bolts 3 attaching coupling 4 which joins the intermediate gear box drive shaft to the transmission shaft. Remove the bolts and the coupling.
 8. Unlock and turn off six bolts 8 attaching fan 1 (Fig.114). Shift the fan upward along shaft tube 6 and temporarily tie it up with a rope to the structure of the fin beam.
 9. Remove cotter pins and turn off the nuts of bolts 7 attaching coupling 5 which joins the intermediate gear box driven shaft to the transmission shaft. Remove the bolts and the coupling.
 10. Remove cotter pins and turn off the nuts of bolts 1 attaching the intermediate gear box to the fin beam (Fig.115).
 11. Drive out the bolts and, supporting the intermediate gear box by hands (2-3 men), lower it on a mat laid inside the fin beam.
 12. Remove the intermediate gear box from the helicopter and lower it on the mat laid on a step-ladder.
 13. Remove the gear box fan from the helicopter.
 14. Put sling 1 on eye bolt 2 of intermediate gear box 3. Using a crane, lower the intermediate gear box from the step-ladder to supports (Fig.113).
 15. Drain oil from the intermediate gear box through drain valve 9 and remove П10-3, CT-1 and П-1 transmitters (Fig.115).
- Note. Close the attachment seats of the transmitters with dummy lids removed from the new gear box after installation of transmitters on it.
16. Process the gear box as specified in the Manufacturer's instructions on processing and deprocessing of the gear box.

(2) Installation

1. Prepare the intermediate gear box for installation on the helicopter. Deprocess the gear box and inspect it for mechanical damage.
2. Install the П10-3, CT-1 and П-1 transmitters on the intermediate gear box (Fig.115).
3. Unlock and turn off bolts 8 attaching intermediate gear box fan 1 and remove the fan (Fig.114).
4. Put the fan on tail shaft tube 6, shift it upward along the tube and temporarily fix to the structure of the fin beam.

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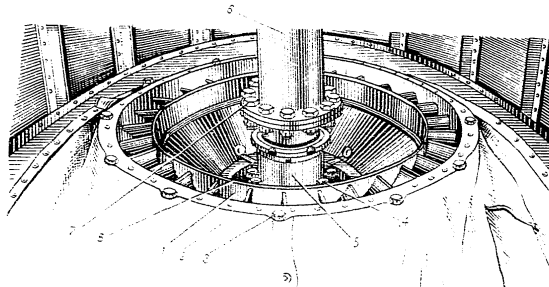


FIG. 114. REAR VIEW OF INTERMEDIATE GEAR BOX, BOTH LOWER FAIRING AND ACCESS DOOR OPENED.

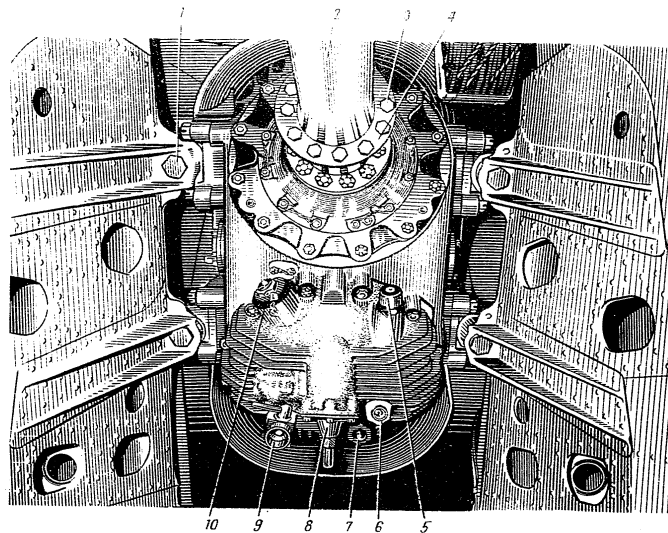


FIG. 115. FRONT VIEW OF INTERMEDIATE GEAR BOX WHEN LOOKING FROM LIN BEAM:
 1 - intermediate gear box attachment bolt; 2 - tail shaft end tube; 3 - bolt for attaching tail shaft tube to coupling;
 4 - flange of tail shaft tube; 5 - oil dipstick; 6 - C-1-1 transmitter; 7 - C-1-1 transmitter; 8 - H110-3 transmitter;
 9 - drain valve; 10 - filler cap.

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5. Put sling 1 on eye-bolt 2 of the intermediate gear box and using a crane lift and place the intermediate gear box on a step-ladder covered with a mat. Remove the sling from the intermediate gear box (Fig.113).

6. Pass the intermediate gear box through access panel 4 into the tail beam and place it on the mat laid on the inner skin.

7. Match the holes on the fin beam brackets and those on the gear box housing for gear box attachment bolts 1 (Fig.115). Install the bolts together with washers and screw up the nuts. Tighten up the bolt nuts with a torque wrench

($M_{\text{torque}} = 23-25 \text{ kg-m}$), and lock them with cotter pins, 3x45.

8. Mount coupling 5 on the intermediate gear box flange and fix it with bolts 7 and 4 to the flanges of the intermediate gear box driven shaft and tail tube 6 (Fig.114). Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

CAUTION. During installation of the bolts for jointing the tubes and couplings of the tail transmission see that the balancing bolts with figure "1" marked on their heads are installed in the holes of the tube flanges marked with figure "1" and the balancing bolts marked with figures 2 and 3 are installed only in holes marked with figures "2" or "3", respectively.

9. Mount coupling and fasten it with balancing bolts 3 to the flanges of the intermediate gear box drive shaft and end tube 2 (Fig.115).

Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

10. Check alignment of the transmission tail shaft tubes in joint with the intermediate gear box. To this end, install the appliance for checking of alignment as illustrated in Figs 121 and 122. Turn the transmission tail shaft with wrench 3 (Fig.120) and make sure that the misalignment as shown on the indicator dial does not exceed 0.4 mm.

Notes: 1. Check the alignment with the tail rotor blades installed.
2. If the misalignment exceeds 0.4 mm, eliminate it by filing the bosses of the gear box attachment brackets as required. During the filing procedure bear in mind that the height of the bosses should be not less than 55.5 mm. Coat the filed surfaces with a primer paint.

11. Install fan 1 on the intermediate gear box and fasten it with bolts. The bolt heads should be fitted with washers (Fig.114). Interlock the bolts in pairs with KO-K1 wire.

Note. Install the fan so that any of four radial grooves on its housing faces one of the lubricating holes located on the shaft coupling.

12. Remove filler cap 10 of the intermediate gear box and fill the gear box with new hypoid gear oil. Check the oil level by oil dipstick 5 (Fig.115). Tighten up the filler cap. Lock the dipstick and the filler cap.

13. Install, tighten up and lock the union nuts of the plug connectors for H10-3, CT-1 and H-1 transmitters (Fig.115).

14. Inspect the installation and removal areas, see that there are no foreign objects and mechanical damage and make sure that the parts have been correctly installed and reliably locked.

15. Install baffle wall 2 on the intermediate gear box housing and fix it with screws 3 (Fig.114). Lock the screws one to another with wire. Attach the baffle wall to the fin beam with screws. Tighten up and lock the screws.

16. Install access panel 4 and fix it with screws (Fig.113). Interlock the screws with KO-K1 wire.

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17. Mount lower fairing 1 and fix it with screws 2. Interlock the screws with KO-K1 wire (Fig.112).
18. Using bolt 4, joint shock strut 3 of the tail bumper to tail bumper frame 5 (Fig.112). Tighten up and lock the bolt nut with cotter pin, 2.5x30.
19. Start the engines and check operation of the intermediate gear box by readings of the check instruments and make sure that the gear box oil system is leak-proof.

IX. REPLACEMENT OF TRANSMISSION TAIL SHAFT

(1) Removal

1. Perform all operations required for removal of the fin beam lower fairing, hatch panel for access to the intermediate gear box and the intermediate gear box fan as laid down in Paras 1, 2, 3, 4, 5 and 9, Section VIII of the present Chapter. Temporarily install the fan in place and secure it with 2-3 bolts.
 2. Remove cotter pins and turn off the nuts of bolts 1 attaching coupling 2 to the intermediate gear box flanges and tube 3. Remove the bolts and the coupling (Fig.116).
 3. Remove cotter pins and turn off the nuts of bolts 1 and withdraw the bolts attaching tube 3 to the flange of splined supporting coupling 7. Remove the tube from the helicopter.
 4. Remove cotter pins and turn off the nuts of bolts 1 attaching tube 5 to the tail gear box flange and withdraw the bolts.
 5. Remove cotter pins and turn off the nuts of bolts 6 attaching support 4 and remove the tube together with the support from the helicopter.
- Note. To prevent bending of tubes and couplings remove the bolts attaching the tube to the support of the coupling in a successive manner except for 2-3 last bolts which should be removed simultaneously from both ends at the moment of tube removal.
6. Remove cotter pins and turn off the nuts attaching the tail shaft flange to the intermediate gear box flange. Remove the bolts.
 7. Remove cotter pins and turn off the nuts of the bolts attaching the tube to the flange of the splined supporting coupling on frame 15 of the tail boom. Remove the bolts and the tube.
 8. Remove cotter pins and turn off the nuts of the bolts attaching tube VIII to the flange of the splined supporting coupling on frame 10 of the tail boom (Fig.117) and four bolts attaching support IX to frame 15. Remove the bolts and tube VIII together with support IX from the helicopter (Fig.117).
 9. Remove tubes VII, VI, V, IV, and III in succession together with their respective supports and remove them from the helicopter.
- Note. Remove protective shroud 4 (Fig.118) before withdrawal of tube IV together with support V fixed on frame 36.
10. Remove cotter pins and turn off nuts 2 of the bolts attaching coupling 3 to flange 7 and nuts 4 of the bolts attaching the coupling and the transmission shaft tube. Remove the bolts and the coupling (Fig.106).
 11. Remove cotter pins and turn off the nuts of the bolts attaching tubes I, and II to the flanges of the splined support couplings on fuselage frames 22 and 26,

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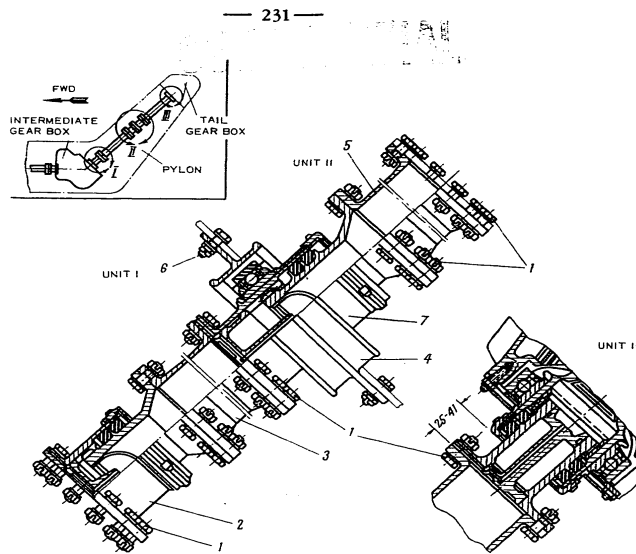


FIG. 116. INSTALLATION OF TRANSMISSION TAIL SHAFT IN FIN BEAM

1 - tube-jointing bolts; 2 - transmission coupling; 3 - end tube; 4 - support fitting; 5 - end tube; 6 - attachment bolts of support fitting; 7 - B1516-200 splined-type support coupling.

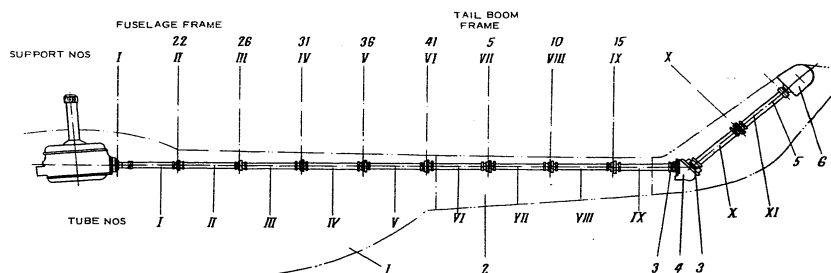


FIG. 117. TAIL ROTOR TRANSMISSION

1 - fuselage central portion; 2 - tail boom; 3 - intermediate gear box coupling; 4 - intermediate gear box; 5 - fin beam; 6 - tail gear box.

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withdraw the bolts and lower the tube on the bottom of the bay between the tank containers (Fig.117).

12. Remove cotter pins and turn off the nuts of the bolts attaching the supports to frames 22 and 26. Withdraw the bolts and remove the supports from the helicopter through the upper hatches.

13. Using the ports in frames No. 22 and 26 pass tubes II and I successively into the top inner space of the fuselage (superstructure) and remove them from the helicopter.

14. Process the tubes and supports as set forth in the Manufacturer's instructions.

(2) Installation

1. Deprocess the parts of the new transmission shaft and make sure that they are not mechanically damaged.

2. Inject hypoid gear oil into the three splined couplings of the end shaft. The oil should be injected into one of the lubrication holes located on the coupling flanges until the excessive oil appears from the opposite lubrication hole.

3. Install the axially-locked couplings (B1516-300) on two tubes (couplings 3 near the intermediate gear box, Fig.117) and bolt them to the tubes. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock with cotter pins, 2.5x30.

Note. The couplings should be attached to the tubes by the tail piece flanges and the flanges of the splined sleeves should be attached to the gear box flanges.

4. Install the B1516-200 splined support coupling in assembly with end shaft support 4 on end tube 5. Attach the B1516-200 coupling to tube 5 by the splined tail piece flange (Fig.116). Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3.0-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

CAUTION. During installation of all jointing bolts of the transmission shaft end tubes see that the balancing bolts marked with figure "1" on the bolt heads are fitted only into the tube flange holes marked with figure "1", and the balancing bolts marked with figures "2" and "3" on their heads are fitted only in the holes marked with figures "2" and "3", respectively.

5. Install the splined support coupling in assembly with the supports on the six tubes of the tail shaft and fasten them as instructed in Para.4.

Note. The splined support couplings should be secured to the tube flanges by their splined sleeve flanges.

6. Pass the end tube together with support 4 into the fin beam. Joint the free flange of the tube to the tail gear box shaft. Install the bolts as laid down in Para.4.

7. Fix the support with bolts 6 to the fin beam rib. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 1.5-2.0 \text{ kg-m}$) and lock with cotter pins, 2.5x25.

Note. To preclude bending of the end tubes, temporarily attach the free ends of the tubes with 2-3 bolts to a respective flange.

8. Pass the tube together with the B1516-300 coupling into the fin beam and bolt it to the tail shaft flange as set forth in Para.4.

9. Remove the intermediate gear box fan, shift it upward along the shaft tube and temporarily tie up with a rope to the fin beam structure.

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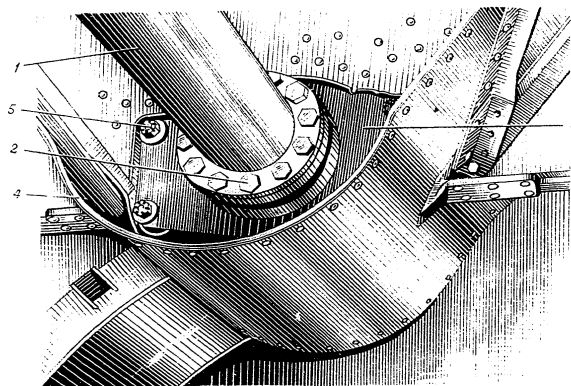


FIG. 118. SUPPORT ON FRAME 56 OF FUSELAGE CENTRAL PORTION
1 - end tube; 2 - tube-jointing bolts; 3 - support; 4 - protective shroud; 5 - support attachment bolt.

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10. Joint the flange of tube X to the flange of intermediate gear box coupling 3. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30 (Fig.117).

11. Mount the fan on the intermediate gear box and secure it with bolts 8. Tighten up the bolts and fasten them one to another with lock wire (Fig.114).

SAUTION. Mount the fan so that any of the four grooves on its housing is placed against one of the lubrication holes on the shaft coupling.

12. Place tube IX together with support 9 into the tail boom. Install the support on the fitting of frame 15 of the tail boom. Fasten the support with bolts. Place washers under the bolt heads and nuts. Tighten up the nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30 (Fig.118).

Notes: 1. The support number is marked on its housing. During installation of the support follow the procedure described in the present instructions.
2. The supports should rest upon the front web of the fitting.
3. All the transmission shaft tubes are interchangeable.
To facilitate the installation procedure, all the transmission tubes are numbered conventionally in Fig.117 and in the text.

13. Joint the flange of the B1516-300 axially-locked coupling of tube IX to the intermediate gear box flange. Tighten up the nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

14. Place tube VIII together with support 8 into the tail boom and fix the support to the fitting of tail boom frame 10 as instructed in Para.12.

15. Joint the flange of tube VII to the flange of the B1516-200 coupling of support 3 located on the tail boom frame. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

16. Install tubes VII, VI, V, IV and III together with B1516-200 couplings and supports by performing operations under Paras 14 and 15.

Notes: 1. The supports should be located as follows:
Support No.7 - on tail boom frame 5.
Support No.6 - on frame 41 of the fuselage central portion.
Support No.5 - on frame 36 of the fuselage central portion.
Support No.4 - on frame 31 of the fuselage central portion.
Support No.3 - on frame 26 of the fuselage central portion.
Support No.2 - on frame 22 of the fuselage central portion.
2. The coupling located at the main rotor brake (B1516-100) should be considered as support No.1 (Fig.117).

17. Pass two shafts through the ports of frames Nos 22 and 26 from the top inner space of the fuselage into the bay between fuel tanks No.9 and No.10. Place one shaft on the bottom of the bay between frames 18-22 and the other - between frames 22 - 26.

18. Mount support 3 on the fitting of frame No.26 and support 2 - on the fitting of frame No.22.

The supports should be mounted as laid down in Para.12 of the present Section for support 9.

19. Joint tube II to the flanges of supports Nos 2 and 3. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

20. Joint the sleeve flange of coupling B1516-100 to the flange of tube No.1. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

21. Joint the flange of coupling B1516-100 to the flange of the main gear box shaft. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m}$) and lock them with cotter pins, 2.5x30.

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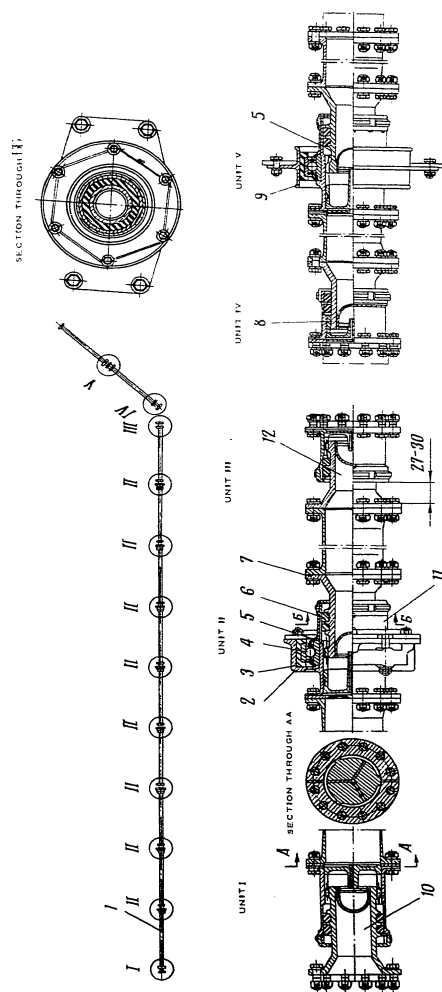


FIG. 119, TRANSMISSION TAIL SHAFT

1 - tail shaft tube; 2 - tail shaft support; 3 - bearing race; 4 - ball bearing; 5 - splayed coupling end piece; 6 - axially-fixed splayed coupling; 7 - B1516-200 splayed coupling; 8 - B1516-200 splayed coupling; 9 - B1516-200 splayed coupling; 10 - B1516-200 splayed coupling; 11 - B1516-200 splayed coupling; 12 - B1516-200 splayed coupling.

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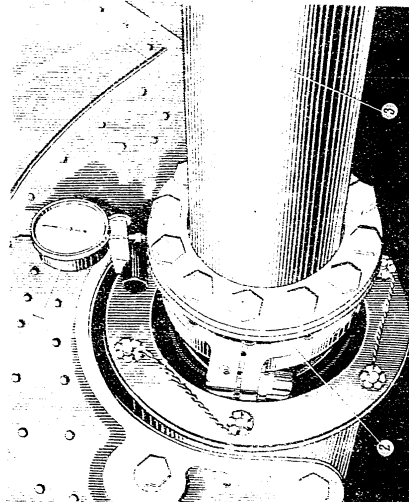


FIG. 11. INSTALLATION OF ATTACHING FOR CHUCKING AND TAIL ARMY OF TWO SHAFTS
1 - fan unit; 2 - fan unit; 3 - fan unit; 4 - fan unit; 5 - fan unit; 6 - fan unit; 7 - fan unit; 8 - fan unit; 9 - fan unit; 10 - fan unit.

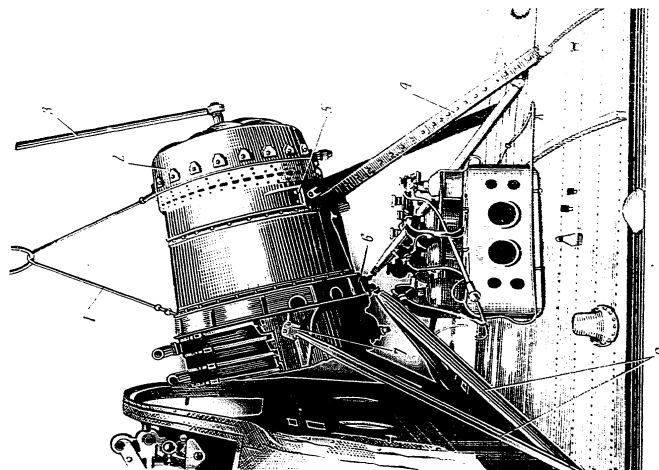


FIG. 12. INSTALLING FAN UNIT IN HULLAGE
1 - fan unit; 2 - fan unit; 3 - fan unit; 4 - fan unit; 5 - fan unit; 6 - fan unit; 7 - fan unit; 8 - fan unit; 9 - fan unit; 10 - fan unit.

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22. Turn the transmission shaft with the B9715-040 wrench (Fig.120) and check the tail shaft splined couplings for angularity and the tubes for run-out by means of special appliance (Figs 121 and 122). The run-out and angularity should not exceed 0.4 mm.

Note. The check should be performed with the tail rotor blades installed.

23. Check the distance between the flanges of the splined tail pieces and the splined sleeve nuts at all joints of the transmission shaft tubes. This distance should be within 27-39 mm (Fig.119).

24. Inspect the removal and installation area and make sure that there are no foreign objects or mechanical damage.

25. Place access panel 4 and fasten it with screws (Fig.113). Fasten the screws one to another with lock wire.

26. Mount lower fairing 1 and fix it with screws 2. Fasten the screws one to another with lock wire (Fig.112).

27. Using bolt 4 joint tail bumper shock strut 3 to tail bumper frame 5.

28. Install all access panels on the fin beam.

X. REPLACEMENT OF FAN DRIVE CARDAN SHAFT

(1) Removal

1. Open covers 10 of the fan compartment cowl and covers 16 of the gear box compartment cowl (Fig.75).

2. Remove cotter pins and turn off nuts 2 securing shroud 1 of the cardan shaft to the main gear box (Fig.123).

3. Shift the cardan shaft shroud forward.

4. Remove cotter pins and turn off nuts 4 of the bolts attaching the cardan shaft flange to main gear box flange (Fig.124).

5. Shift the cardan shaft together with the shroud away from the gear box flange and remove the shroud.

6. Disengage the cardan shaft from the fan shaft and remove it.

(2) Installation

1. Coat the cardan shaft splines and the fan shaft splines with HK-50 grease.

2. Place the cardan shaft into the fan shaft splines, align flanges 5 and 6, install bolts 3, screw up nuts 4 (Fig.124) and tighten them up with a torque wrench. The torque moment should be 7-8 kg-m.

3. Mount the base of appliance 2 on three studs 3, screw up and tighten nuts 4 (Fig.125).

4. Fit indicator 1 on the appliance and place the indicator post so that it is in touch with the cardan shaft surface.

5. Using wrench 3 (Fig.120), turn the fan shaft and check the run-out of the cardan shaft by the indicator readings. The shaft run-out should not exceed 0.4 mm.

6. Remove the indicator, turn off the nuts and take the appliance away.

Note. If the shaft run-out exceeds 0.4 mm, adjust the alignment as instructed in Para.15 of Section XI and check the run-out value as specified in Paras 3-6.

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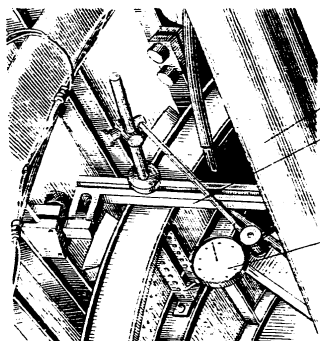
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FIG. 11. INSTALLATION OF APPLIANCE FOR CHECKING FAN SHAFT FLANGES
(FOR BOX 10)

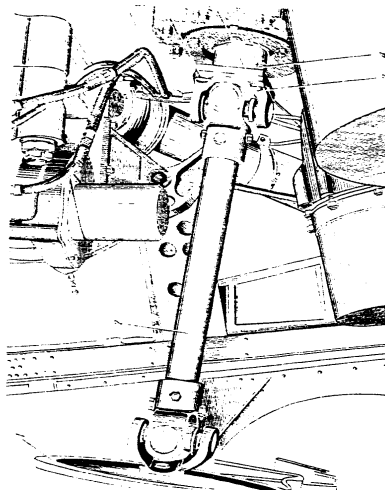


FIG. 12. INSTALLATION OF FAN DRIVE CARDAN SHAFT
1 - fan, 2 - 40x14-20 fan drive cardan shaft, 3 - bolt for attaching cardan shaft flange to main gear box flange, 4 - nut for attaching cardan shaft flange to main gear box flange, 5 - main gear box flange, 6 - cardan shaft flange.

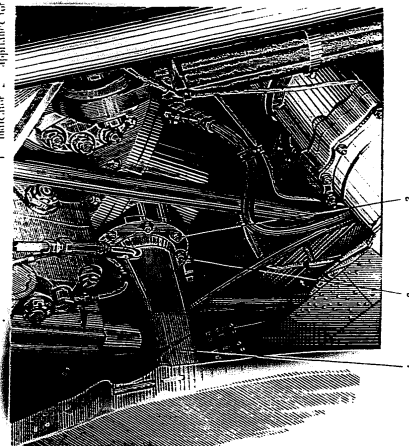


FIG. 13. INSTALLATION OF FAN DRIVE CARDAN SHAFT SHROUD
1 - cardan shaft shroud, 2 - nut for attaching shroud to main gear box, 3 - main gear box stud.

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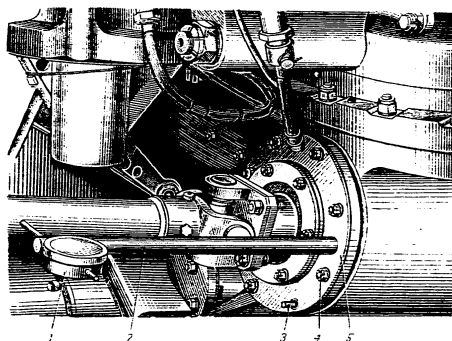


FIG. 125. INSTALLATION OF c386-0521 APPLIANCE FOR CHECKING RUN-OUT OF FAN DRIVE
CARDAN SHAFT
1 - indicator; 2 - c386-0521 appliance; 3 - main gear box stud; 4 - nut for attaching appliance to main gear box studs; 5 - base plate of c386-0521 appliance.

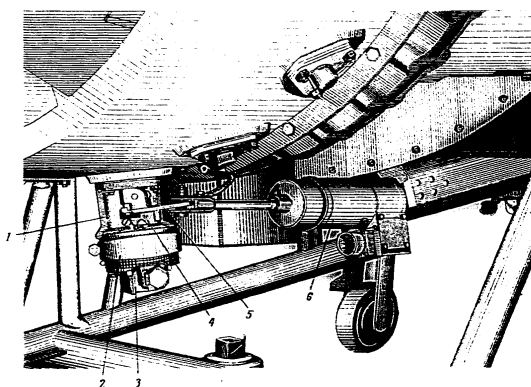


FIG. 126. INSTALLATION OF VHM-1 TRANSMITTER ON FAN UNIT
1 - VHM-1 transmitter attachment bracket; 2 - VHM-1 transmitter attachment clamp; 3 - VHM-1 transmitter of guide vane position indicator; 4 - carrier of VHM-1 transmitter; 5 - guide vane turn lever; 6 - VII-100V electric mechanism for controlling fan unit guide vanes.

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7. Turn off the nuts of bolts 3 securing cardan shaft flange 6 to main gear box flange 5 (Fig.124).

8. Move the cardan shaft away from the main gear box flange, install the cardan shaft shroud and shift the shaft forward.

9. Align flanges 5 and 6, insert the bolts, screw up the nuts and tighten them up with a torque wrench. The nut torque moment should be 7-8 kg-m.

10. Shift the cardan shaft shroud backward, place it on the studs, screw up the nuts and tighten them up with a torque wrench. The nuts should be tightened with a torque moment of 4-4.5 kg-m.

XI. REPLACEMENT OF FAN UNIT

(1) Removal

1. Remove the top section of fan compartment cowl 9 (Fig.75).

2. Remove the fan drive cardan shaft as specified in Section X.

3. Drain oil from the oil coolers. Disconnect the oil system piping from the oil coolers and the main gear box, engine oil coolers and breather tanks. Close the pipe ends and connections with blind caps. Turn off the bolts and remove the breather tanks.

4. Disconnect the ventilation and air cooling pipes from the fan unit and close the pipe ends and connections with blind caps.

5. Disconnect the pipe of the fire fighting system from the fan unit and close the pipe ends with blind caps.

6. Disconnect the electric cables from the MH-100M electric mechanism and the YHFM-1 transmitter.

7. Attach the B9901-550A slings to the fan unit and put the sling ring on the crane hook (Fig.120).

8. Supporting the fan unit with the crane, disengage the braces and the cross-piece from the fan unit.

9. Remove oil coolers 2 and 9 (Fig.127), oil cooler attachment bands 4 and 8, partition 3 (Fig.127), cross-piece attachment brackets and braces 5, 6, and 7 (Fig.120) as well as air cooling trunks of the power plant accessories and transmitter 3 (Fig.126) from the helicopter.

10. Install the fan unit on supports and process.

(2) Installation

1. Deprocess the fan unit.

2. Fasten the B9901-550A slings to the new fan unit, put the slings on the crane hook and lift slightly the fan unit.

3. Install brackets 5, 6, and 7 (Fig.120) fitted with adjusting shims on the fan unit housing, screw up the nuts and tighten them with a torque wrench. The nuts should be tightened with a torque moment of 1.5-2 kg-m.

Note. Locking of nuts and bolts should be performed after adjustment of alignment as specified in Paras 14 and 15.

4. Mount partition 3 on the fan unit (Fig.127) and cooler attachment bands 4 and 8.

5. Attach 2-mm thick rubber cushions (rubber 922) to the front end faces of the engine oil cooler attachment housing by means of glue No.88.

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6. Put rubber cushions 10 and shutters 7 (Fig.127) on the engine oil coolers.
 7. Install the engine oil coolers in the fan unit housing and fix them with bands 8 (Fig.127). Lock the band clamping bolts with wire KO-KO.8.
 8. Using glue No.88, attach rubber cushions 5 (Fig.127) on the main gear box oil coolers, install the latter in the fan unit housing and fix them with bands 4. Lock the band clamping bolts with wire KO-KO.8.
 9. Mount carrier 4 on the pivot of transmitter 3 (Fig.126). Before doing it, remove the lever from the transmitter pivot.
 10. Mount transmitter 3 on bracket 1 so that the dowel pin on the transmitter housing enters the bracket hole. In this case carrier 4 should be placed in the extreme position and the dowel pin of lever 5 should enter the carrier fork. The extreme position of the carrier should conform to the extreme position of the lever.
 11. Fix the transmitter with a fastening clamp and lock the bolt with a cotter pin.
 12. Mount the air cooling and ventilation trunks on the studs of the fan unit housing and secure them with nuts.
 13. Lift the fan unit with a crane, match the holes in brackets 5, 6, and 7 (Fig.120) with the holes in the mating fittings of cross-piece 4 and braces 8, install attachment bolts in the matched holes and screw up the nuts without tightening.
 14. Attach the 6360/0735 appliance to the gear box jointing flange and check the following (Fig.128):
 - the distance from the gear box jointing flange to the end face of the ball bearing thrust ring of the fan unit shaft which should be within 622 ± 5 mm;
 - the displacement of the fan unit shaft axis with respect to the gear box drive shaft axis. The distance between the outer surface of the fan unit shaft splines and the pointed end of the appliance ram during rotation of the gear box drive shaft should not exceed 10 mm. To rotate the gear box drive shaft make use of the main rotor brake drum.
 15. Remove the appliance from the gear box jointing flange, mount it on the splines of the fan unit shaft and check the distance between the end face of the centering bead of the gear box jointing flange and the pointed end of the appliance ram. This distance should not exceed 10 mm at any position of the fan unit shaft. The fan unit shaft should be rotated by means of the B9715-040 wrench (Fig.128). If, however, the check of the fan unit position performed in compliance with Paras 14 and 15 shows that the above indicated dimensions do not meet the technical requirements, regulate the position of the fan unit by adjusting the length of braces 8 (Fig.120). During adjustment see that the thread of brace tail pieces does not project beyond the check holes. In case of necessity it is allowed to adjust the fan unit position by height within 5 mm by changing the thickness of adjusting shims placed under brackets 5, 6, and 7 (Fig.120).
 16. Lock the nuts of the bolts attaching brackets 5, 6, and 7 (Fig.120) to the fan unit housing by bending the tabs of the locking plates.
 17. Tighten up the nuts of the bolts attaching the fan unit to the cross piece and the braces with a torque of 1.5-2 kg-m.
 18. Connect the electric wires to the MU-100M electric mechanism and the VJPH-1 transmitter, check functioning of the guide vane assembly and adjustment of the transmitter.
- When the vanes of the guide vane assembly are fully closed, the pointer of the VJPH-1 indicator installed on the flight engineer's instrument board should set against zero within ± 1 mm and the gap between the vanes should be 1-5 mm.

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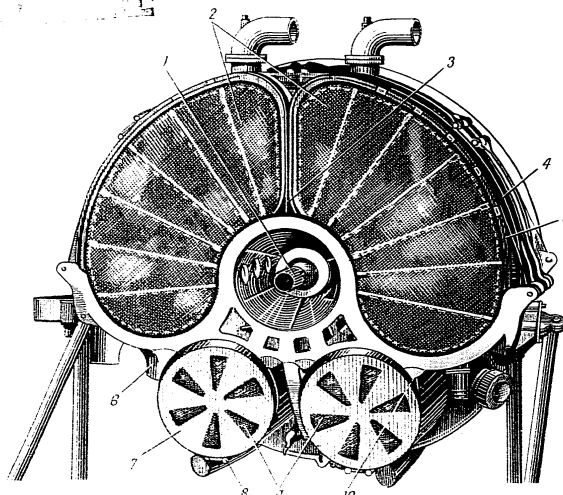


FIG. 127. FAN UNIT

1 - fan shaft; 2 - main gear box oil coolers; 3 - partition; 4 - attachment bands of main gear box oil coolers; 5 - rubber cushion; 6 - air supply connection; 7 - engine oil cooler shutter; 8 - engine cooler attachment bands; 9 - engine oil coolers; 10 - rubber cushion.

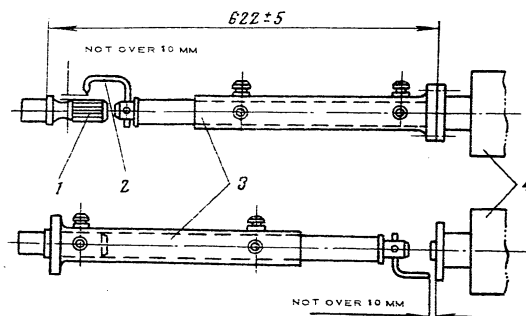


FIG. 128. INSTALLATION OF APPLIANCE FOR CHECKING FAN UNIT SHAFT AND MAIN GEAR BOX DRIVE SHAFT FOR AXIAL ALIGNMENT

1 - fan unit shaft; 2 - pointer; 3 - 6360/0735 appliance; 4 - main gear box drive flange.

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The adjustment should be carried out by turning the transmitter pivot with an effort applied to the hexahedron. Before doing it, back off the bolt attaching the carrier to the transmitter pivot. The adjustment over, tighten up and safety the bolt with lock wire.

19. Install the breather tanks.
20. Connect the pipe-lines of the oil, fire fighting, air cooling and ventilation systems.
21. Install the fan drive cardan shaft.
22. Mount the upper section of the fan compartment cowl.
23. Fill the oil system with oil and make sure that the pipe connections are leak-proof.

XII. REPLACEMENT OF GFC-90/360 GENERATORS

(1) Removal

1. Extend the cowl work platforms and open the hatch cover of the tail compartment cowl.
2. Remove terminal box cover 3 (Fig.107) from the generator, disconnect bunched conductors 1 and install the cover in place.
3. Remove the clamps and disconnect the air cooling pipe from the generator air trunk 2.
4. Turn off and remove eight nuts attaching the generator to the main gear box and remove the generator.
5. Remove the other generator by performing operations specified in Paras 2 and 4.

CAUTION. 1. During removal of the generators take care not to revolve generator shafts otherwise the generators may get out of phase.

2. With one generator mounted it is not allowed to revolve the gear box shaft until the installation of the other generator is over.

(2) Installation

1. Remove the retaining clamp from the new generator and try to revolve the generator rotor shaft by hand. If the shaft does not revolve it means that the generator is in phase.

Note. When installing a generator with the lock washer sheared, i.e. when the generator has already been in use, it is necessary to set the rotor shaft by match marks 6 (Fig.129) made in red enamel on clamping ring 5 and rotor nut 2. After installation of the generators make sure that the generators are in phase. The check should be performed in conformity with recommendations contained in the Generator Description.

2. Turn nuts off bolts 6 and remove trunk 2 from the generator.
3. Mount the generator on the studs of the P-7 main gear box by matching the splines of the generator shaft and the gear box. Put the nuts and tighten them up with a torque wrench to a 7-8 kg-m torque.
4. Make sure that match marks 6 on rotor nut 2 and clamping ring 5 coincide (Fig.129).
5. Install trunk 2 on the generator (Fig.107).
6. Connect the air cooling piping to generator trunk 2.

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7. Remove the terminal box covers from the new generator, connect bunched conductors 1 to the generator terminals and put the covers in place.
8. Install the other generator in a similar way.

Note. In case only one generator is replaced it is necessary to bring the generators in phase just after installation of the new generator. The adjustment should be carried out as specified in the Generator Description.

9. Close the hatch cover of the tail compartment cowl and retract the cowl work platforms.

(3) General Instructions for Removal and Installation of Longitudinal, Lateral, Collective-Pitch and Foot Control Hydraulic Boosters

Before removal of the hydraulic boosters proceed as follows:

1. Lock the control bell cranks on frame 14 in neutral position.
2. Using the 4296A appliance release compressed nitrogen so that the pressure in the hydraulic accumulators drops to zero.
3. Drain AMT-10 oil through the hydraulic reservoir drain valve.
4. When disconnecting the hydraulic piping prevent fouling of the hydraulic system components and prevent entry of dirt and foreign objects into the hydraulic system.

After installation of the hydraulic boosters on the helicopter, proceed as follows:

1. Fill the hydraulic reservoir with AMT-10 oil.
2. Charge the hydraulic accumulators with compressed nitrogen.
3. Make sure that there is no leakage in the pipes-to-hydraulic boosters connections.
4. Check functioning of the hydraulic boosters on the ground, using VTH air-field hydraulic unit.
5. After installation of the hydraulic boosters check adjustment of the swash-plate ring angles of tilt and adjustment of the foot control system.

XIII. REPLACEMENT OF HV-32A COLLECTIVE PITCH HYDRAULIC BOOSTER

(1) Removal

1. Extend the work platforms, open the cowl covers and the hatch cover near frame 14.
2. Disconnect the bonding jumper from link rod 1.
3. Remove the bolts attaching link rod 1 to hydraulic booster slide bell crank 3 (Fig.102) and to control bell crank 9 and remove the link rod without disturbing its length.
4. Turn off the nut attaching hydraulic booster shackle 4 to the swashplate collective pitch lever and drive out the pin.
5. Unlock the union nuts of the hydraulic booster pipes and disconnect the pipes from the hydraulic booster pipe unions.
6. Wrap up the open ends of the disconnected pipes with calico cloth and cellophane and seal them.

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7. Turn off six nuts 5 attaching the hydraulic booster to the plate and remove the hydraulic booster by means of the 50-9901-50 sling.
8. Remove bracket 11 together with bell crank 9 (Fig.102) from the hydraulic booster housing end face.
9. Process the removed hydraulic booster as set forth in the respective instructions.

(2) Installation

1. Deprocess the new hydraulic booster and prepare it for installation on the helicopter.
 2. Mount the bracket together with bell crank 9 (Fig.102) on the hydraulic booster studs.
 3. Using the 50-9901-50 sling, lift the hydraulic booster from the ground and install it on the plate studs. The nuts should be tightened with a torque of 48-53 kg-m.
 4. Engage the hydraulic booster shackles with the swashplate collective pitch lever.
 5. Engage link rod 1 with hydraulic booster bell crank 3 and control bell crank 9.
 6. Connect the bonding jumper to the link rod.
 7. Successively remove the blind caps and connect the pipes to the hydraulic booster pipe unions.
 8. Make sure that there is no leakage through the pipes-to-hydraulic booster pipe unions connections.
 9. Adjust the collective pitch control system with the hydraulic system engaged as set forth in Section "Adjustment of Helicopter Control System".
 10. Check functioning of the duplicating system emergency switching mechanism in the following sequence:
 - (a) using a feeler gauge, check the clearance between the limiting rest and the end switch rod of the duplicating hydraulic system emergency switching mechanism which should be within 1.8-2.5 mm. Clicking of the microswitch indicates that the clearance has been completely taken up.
 - (b) connect the VHT airfield hydraulic unit and raise pressure in the main hydraulic system;
 - (c) set the collective pitch-throttle control lever in true mid-position;
 - (d) mount the 6368/0038 appliance as illustrated in Fig.131 without disturbing the mid-position of bell crank 3. The appliance imitates binding of the hydraulic booster slide and is intended for binding the collective pitch control linkage before the hydraulic booster;
 - (e) turn on all the toggle switches and circuit breakers of the main and duplicating systems, switch on the VHT airfield hydraulic unit and raise pressure in the main hydraulic system.
- The pressure gauge of the main hydraulic system should indicate the operating pressure within 120-155 kg/sq cm and the green lamp on the pilot's central instrument board should burn;
- (f) attach the dynamometer loop at the middle of the collective pitch-throttle control lever and apply an effort to pull the lever.
- As soon as the dynamometer reads 70±10 kg the microswitch contacts of the duplicating hydraulic system emergency switching mechanism should close, the green

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lamp on the pilot's central instrument board should go out and the light panels DUPLICATING SYSTEM ON and SWITCH ON MAIN HYDRAULIC SYSTEM should come on.

The duplicating hydraulic system pressure gauge should indicate the working pressure within 120-155 kg/sq cm.

Note. If, however, the duplicating hydraulic system fails to engage at an effort of 70-10 kg it is necessary to adjust the clearance between the mechanism contacts, leaving it within 1.8-2.5 mm. When adjusting, see that the microswitch rod does not protrude beyond the contour of the adjusting screw.

(g) relieve the collective pitch-throttle control lever and turn off and then on the main hydraulic system toggle switch on the pilot's central instrument board or the circuit breakers on the flight engineer's instrument board. As a result, the main hydraulic system should engage and the duplicating system should get disengaged.

(h) check the duplicating hydraulic system for proper engagement 2-3 times;

(i) lock the switch adjusting screw together with the lock nut to the mechanism casing;

(j) remove the appliance and connect the control linkage which has been disconnected during installation of the appliance;

(k) check functioning of the collective pitch hydraulic booster. The control lever should move smoothly and without binding through the whole range.

11. Retract the work platforms, close the cowl covers and the hatch cover located near frame 14.

XIV. REPLACEMENT OF EV-33A LATERAL (LONGITUDINAL) CONTROL HYDRAULIC BOOSTER

(1) Removal

1. Extend the work platforms, open cowl covers and the hatch cover located near frame 14.
2. Disconnect the bonding jumpers from link rods and bell cranks.
3. Turn off the nut, drive out the bolt and disengage bell crank 6 from link-rod 8 (Fig.102).
4. Turn off the nuts, drive out pins 6 and 10, disengage rod 9 from hydraulic booster bell crank 5 and the swashplate lever (Fig.101).
5. Disconnect the electric cables from the HOC-800 transmitter.
6. Disconnect the pipe-lines from the hydraulic booster, close the open ends of the disconnected pipes with calico cloth and cellophane and seal them.
7. Turn off nuts 12 attaching the hydraulic booster to the plate and remove the hydraulic booster by means of the 50-9901-50 sling.
8. Turn off the nut and drive out bolt 4 attaching fork 2 to hydraulic booster slide bell crank 3.
9. Turn off two nuts, withdraw bolts 15 attaching bell crank 1 to the hydraulic booster body and remove the bell crank.
10. Turn off the bolts and remove the bracket together with the HOC-800 transmitter from the hydraulic booster body. Before doing it, disconnect the link together with the clamp from actuating bell crank 5.
11. Process the removed hydraulic booster as specified in the respective instructions.

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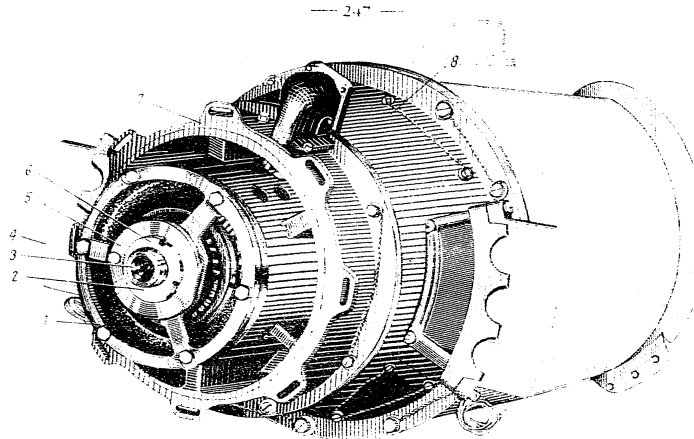


FIG. 129. GENERATOR WITH AIR CRANK REMOVED
1 - shaft; 2 - pin; 3 - pin; 4 - pin; 5 - pin; 6 - pin; 7 - pin; 8 - pin.

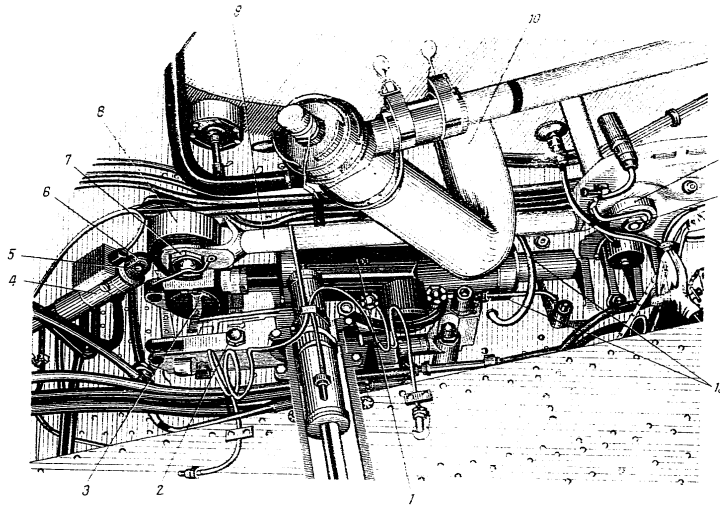


FIG. 130. INSTALLATION OF FOOT CONTROL HYDRAULIC BOOSTER
1 - 15V-25A hydraulic booster; 2 - hydraulic booster attachment nut; 3 - clamp for connection of link-rod from foot control unit; 4 - foot control link-rod; 5 - bolt for attaching link-rod to hydraulic booster slide bell crank; 6 - hydraulic booster slide bell crank; 7 - pin for connecting power link-rod to hydraulic booster actuating bell crank; 8 - hydraulic booster actuating bell crank; 9 - link-rod from hydraulic booster to worm gear mechanism; 10 - main gear box filler neck; 11 - worm gear mechanism arm; 12 - pin for connecting power link-rod to worm gear mechanism arm; 13 - hydraulic system pipe.

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(2) Installation

1. Deprocess the hydraulic booster and prepare it for installation on the helicopter.
2. Fix the bracket together with the AOC-800 transmitter on the hydraulic booster body, install the clamp and connect the link rod.
3. Install bell crank 1 in the eye-lugs of the hydraulic booster and fasten it with bolts 15 (Fig.101).
4. Engage fork 2 with hydraulic booster slide bell crank 3 and insert the bolt. Tighten up the bolt nut and cotter pin it.
5. Mount the hydraulic booster on the plate studs and secure it with nuts. The nuts should be tightened with a torque of 18-20 kg-m.
6. Connect rod 9 to actuating bell crank 5 and the swashplate lever.
7. Connect bell crank 6 to control link-rod 8 (Fig.102).
8. Connect the electric wires to the AOC-800 transmitter.
9. Connect the bonding jumpers to the link-rods and bell cranks.
10. Successively remove the blind caps and connect the pipe-lines to the hydraulic booster pipe unions.
11. Make sure that there is no leakage through the pipes-to-hydraulic booster pipe union connections.
12. Adjust the swashplate ring angles of tilt as instructed in Section "Adjustment of Helicopter Control System".
13. Check functioning of the duplicating hydraulic system emergency engagement mechanism as specified in Para.10, "Booster Installation".

Notes: 1. Before checking functioning of the duplicating hydraulic system emergency engagement mechanism make sure that all the control circuit breakers and toggle switches of the autopilot are off.

2. Set the control stick in the neutral position by the spring feel mechanism indicator.

3. Mount the 6368-0043A appliance (Fig.131) on the longitudinal control hydraulic booster. The effort at which the emergency engagement mechanism operates should be 80-100 kg.

4. Mount the 6368-0044A appliance on the lateral control hydraulic booster (the installation procedure is similar to that of the 6368-0043A appliance). The effort at which the emergency engagement mechanism operates should be 70-100 kg.

The effort applied to the control lever is determined by means of the 64700/2323 appliance.

XV. REPLACEMENT OF EV-33A FOOT CONTROL HYDRAULIC BOOSTER

(1) Removal

1. Extend the work platforms and open the access panel at frame 14.
2. Disconnect the bonding jumper from link-rod 9 (Fig.130).
3. Screw off the attachment nuts of link-rod 9, drive out pins 7 and 12 and remove the link-rod. Disconnect link-rod 4 from slide bell crank 6 of the hydraulic booster.
4. Disconnect the electric wires from the AOC-800 transmitter.
5. Disconnect pipes 13 from the hydraulic booster pipe unions.
6. Close the disconnected ends of the pipes with calico cloth and cellophane and seal them.
7. Turn off nut 2 attaching the hydraulic booster to the plate, swing the pipes aside and remove the hydraulic booster by means of the 549901-50 sling.
8. Turn off the bolts and remove the bracket together with the AOC-800 transmitter from the hydraulic booster body. Before doing it, disengage the link-rod with clamp 3 from actuating bell crank 8.

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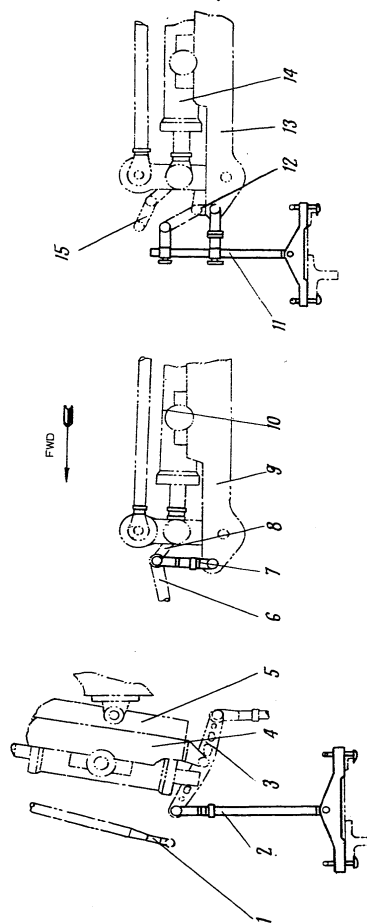


FIG. 131. INSTALLATION OF APPLIANCES FOR CHECKING FUNCTIONING OF DUPLICATING HYDRAULIC SYSTEM ENGAGEMENT MECHANISMS

1 - control link-rod; 2 - appliance No. 6368/0038; 3 - control bell crank; 4 - 13Y-32A hydraulic booster of collective pitch; 5 - booster base plate; 6 - control link rod; 7 - appliance No. 6350/0348; 8 - bell crank; 9 - booster base plate; 10 - 13Y-32A hydraulic booster of foot control system; 11 - appliance No. 6368/0043A; 12 - bell crank; 13 - booster base plate; 14 - 13Y-32A hydraulic booster of longitudinal control system; 15 - link.

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9. Process the removed hydraulic booster as specified in the respective instructions.

(2) Installation

1. Reprocess the hydraulic booster and prepare it for installation on the helicopter.
2. Secure the bracket together with the 400-600 transmitter on the hydraulic booster body, install clamp 3 and connect the link-rod.
3. Mount the hydraulic booster on the plate studs and fasten it with nuts 2. Tighten up the nuts with a torque of 18-20 kg-m.
4. Connect link-rod 9 to hydraulic booster actuating bell crank 8 and worm gear mechanism arm 11.
5. Engage fork of link-rod 4 to hydraulic booster slide bell crank 6.
6. Connect the bonding jumper to the link-rod.
7. Connect the electric wires to the 400-600 transmitter.
8. Remove the calico cloth and cellophane from the pipes, take off the blind caps from the hydraulic booster pipe unions and connect the pipe-lines to the hydraulic booster.
9. Make sure that the pipes are leak-proof in joints with the hydraulic booster pipe unions.
10. Check adjustment of the foot control system as set forth in Section "Adjustment of Helicopter Control System".
11. Check functioning of the duplicating hydraulic system emergency engagement mechanism as specified in Para. 10, Booster Installation.

Notes: 1. Before checking of the duplicating hydraulic system emergency engagement mechanism for proper functioning make sure that all the circuit-breakers and toggle switches of the autopilot control system are cut off.

2. The foot control pedals are set in the neutral position by the spring feel mechanism indicator.

3. Install the 6350/0348 appliance on the foot control hydraulic booster (Fig. 132). The emergency engagement mechanism should operate when the applied force is 13-15 kg. The force on the pedals is determined by means of the 64700/2321 appliance.

XVI. REPLACEMENT OF WORM GEAR MECHANISM

(1) Removal

1. Extend the work platforms of the cowls and open the service panel of the gear box compartment.
2. Remove the foot control hydraulic booster (Section XV of the present Chapter).
3. Unlock the turnbuckles of the foot control wire ropes in the top inner space of the fuselage and free the wire ropes.
4. Turn off the nuts of the bolts attaching bracket 1 to the gear box compartment panel and withdraw the bolts (Fig. 132).
5. Disconnect the bonding jumpers from shaft 3 and worm gear mechanism arm 6.
6. Disengage the shaft from worm gear mechanism 5 by shifting bracket 1 together with the drum towards the service hatch.
7. Remove cotter pins and turn off nuts 8 attaching the worm gear mechanism to the plate.
8. Remove the worm gear mechanism from the helicopter through the service hatch.

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9. Process the worm gear mechanism as specified in the Manufacturer's instructions.

(2) Installation

1. Prepare the worm gear mechanism for installation on the helicopter in the following way:
 - (a) deprocess and examine the worm gear mechanism for mechanical damage;
 - (b) check presence of seals on adjusting bolts 4 and the angle of turn of arm 6 (the arm angle of turn should be not less than $\pm 45^\circ$).
2. Install mechanism 5 on the plate studs, screw on nuts 8 and tighten them with a torque wrench (torque = 7.5-8.5 kg-m). Lock the nuts with cotter pins, 2.5x30.
3. Install the foot control hydraulic booster (Section XV of the present Instructions).
4. Set the worm gear mechanism arm and the drum with the wound up wire rope in mid-position. In this case dimension "A" should be 127.5-1 mm (see Chapter V, Section "Adjustment of Tail Rotor Control System").
5. Engage coupling shaft 3 with the worm gear mechanism splines and fix bracket 1 on the gear box compartment panel.
6. Connect the foot control wire ropes and tighten them with an effort of 90-110 kg (the difference in tension of the main and the duplicating wire ropes should not exceed 10 kg). Lock the turnbuckles with KO-KL wire.
7. Connect the bonding jumpers to the coupling shaft and the worm gear mechanism arm.
8. Inspect the removal and installation area, make sure that the wire ropes are properly laid on the drum and the worm gear mechanism bolts are locked.
9. Check adjustment of the foot control system as set forth in Section "Adjustment of Tail Rotor Control System" (Chapter V).

XVII. REPLACEMENT OF TAIL GEAR BOX

(1) Removal

1. Remove the tail rotor hub together with the blades (Section XVIII of the present Chapter). ⁽¹⁶⁾
2. Unlock and turn off the attachment screws of fin beam top fairing 8 (Fig. 134) and remove the fairing.
3. Unlock and disengage the plug connector from the CT-1 transmitter (Fig. 133).
4. Turn off the tail light attachment screws, disconnect the electric wire lugs from it and remove the clamp attaching the electric wires to the fin beam.
5. Unlock and turn off the screws attaching fixed rudder 9 and remove the latter from the helicopter (Fig. 134).
6. Unlock the turnbuckle of the foot control wire ropes in the tail beam and slacken the wire ropes.
7. Remove access lid 4 on the tail gear box and open access panel 6 on the fin beam (Fig. 135). Remove fin beam upper access panel 10 (Fig. 134).
8. Disconnect the end of chain 2 from the wire rope and remove it from tail gear box sprocket 3 (Fig. 135).
9. Disengage the plug connectors at HIO-3 and H-1 transmitters of the tail gear box.

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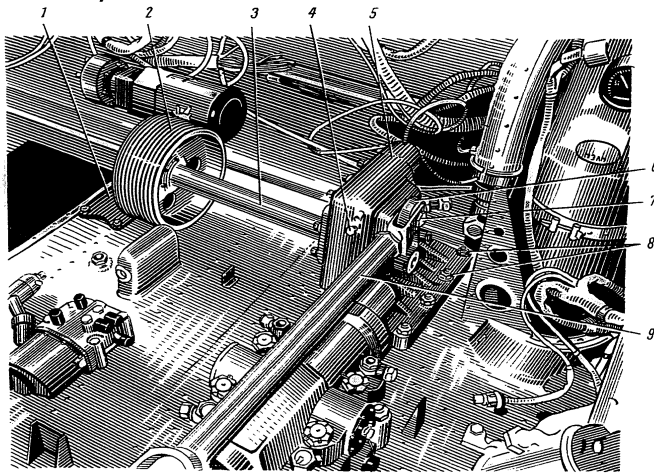
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FIG. 132. INSTALLATION OF WORM GEAR MECHANISM WITH DRUM
 1 - bracket; 2 - drum; 3 - coupling shaft; 4 - adjusting bolt; 5 - worm gear mechanism; 6 - worm gear mechanism arm; 7 - pin for connecting power link-rod to arm; 8 - worm gear mechanism attachment nut; 9 - power link-rod for connection of worm gear mechanism to ES-33A hydraulic booster.

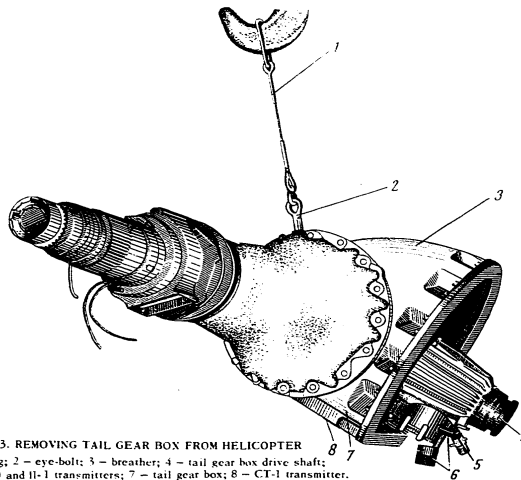


FIG. 133. REMOVING TAIL GEAR BOX FROM HELICOPTER
 1 - B9901-50 sling; 2 - eye-bolt; 3 - breather; 4 - tail gear box drive shaft; 5 - drain valve; 6 - H110-3 and H-1 transmitters; 7 - tail gear box; 8 - CT-1 transmitter.

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10. Unlock and turn off the nuts and withdraw the bolts joining tail gear box drive shaft 4 to the transmission shaft.
11. Screw eye-bolt 2 of the B9901-50 sling into the tail gear box housing, put the sling ring on the crane hook and tighten up the wire rope (Fig.133).
12. Remove cotter pins and turn off nuts 5 of the bolts attaching the tail gear box to the fin beam (Fig.135) and withdraw the bolts.
13. Using the crane remove the tail gear box from the helicopter and place it on supports.
- CAUTION. When placing the gear box on supports take care not to damage the CT-1 transmitter.
14. Remove the H10-3, CT-1 and H-1 transmitters from the helicopter and drain off the oil.
- Note. Close the transmitter attachment seats with dummy lids removed from the new gear box after installation of transmitters on the gear box.
15. Process the gear box in compliance with the Manufacturer's instructions.

(2) Installation

1. Prepare the tail gear box for installation on the helicopter. Deprocess and inspect the tail gear box for mechanical damage.
2. Mount the H10-3, CT-1 and H-1 transmitters on the tail gear box.
3. Screw eye-bolt 2 (Fig.133) of the B9901-50 sling into the tail gear box housing, lift the tail gear box with a crane and place it on the fin beam flange (Fig.135).
4. Align the jointing bolt holes in the tail gear box housing and the fin beam.
5. Install tail gear box attachment bolts. Tighten up the bolt nuts with a torque wrench ($M_{\text{torque}} = 8-9 \text{ kg-m.}$) and lock them with cotter pins, 2.5x35 (Fig.135). Remove the slings from the gear box.
6. Bolt tail gear box drive shaft 4 (Fig.133) to the transmission shaft. Screw up the bolt nuts without tightening.
- CAUTION. When installing the bolts, see that only balancing bolts marked with figure "1" on their heads are fitted into the holes of the transmission shaft tube flange marked with figure "1" and balancing bolts marked with figure "2" or "3" on their heads are fitted only into the holes marked with figure "2" or "3", respectively. (7)
7. Install the tail rotor hub together with the blades (see Section XVIII of the present Chapter).
8. Check alignment of the transmission shaft tubes in the fin beam. Install the appliance for the alignment check as illustrated in Figs 121, 122 and turn the transmission tail shaft with wrench 3 (Fig.120) to make sure that the misalignment shown by the indicator dial does not exceed 0.4 mm.
- Note. The alignment check should be performed only with tail rotor blades installed.
9. Finally tighten up the nuts of the bolts joining the tail gear box drive shaft to the transmission shaft with a torque wrench ($M_{\text{torque}} = 3-3.5 \text{ kg-m.}$). Lock the nuts with cotter pins, 2.5x30.
10. Mount fixed rudder 9 and top fairing 8 (Fig.134) and lock the attachment screws of the fairing and the rudder with K0-K1 wire.

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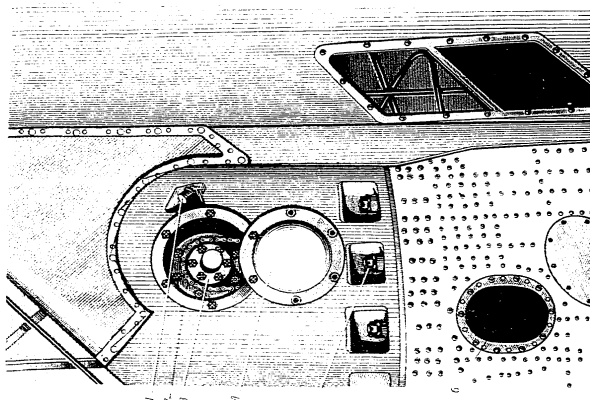


FIG. 135. ATTACHMENT OF TAIL GEAR BOX TO FIN BEAM

- 1 - oil dipstick; 2 - chain; 3 - sprocket; 4 - access lid;
- 5 - nuts of tail gear box attachment bolts; 6 - access panel.

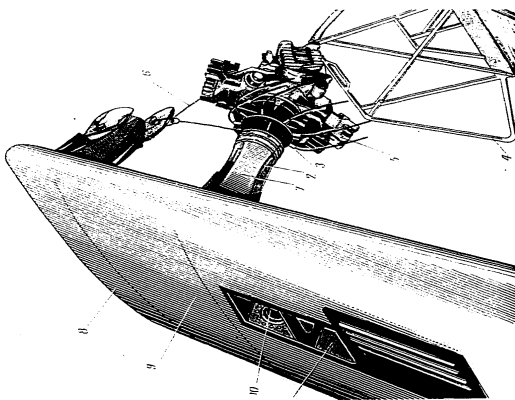


FIG. 134. LIFTING TAIL ROTOR HUB BY SLINGS

- 1 - access panel on fixed rudder; 2 - pipe; 3 - bracket;
- 4 - TC-8 maintenance platform; 5 - tail rotor hub; 6 - slings for lifting tail rotor hub; 7 - tail gear box; 8 - top fairing; 9 - fixed rudder; 10 - fin beam access panel.

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11. Put chain 2 on tail gear box sprocket 3 (Fig.135) and connect the chain end to the foot control wire rope. Screw the nut of the bolt joining the links of the chain and the wire rope, tighten it and lock with a cotter pin.

12. Using the turnbuckles, adjust the tension of the foot control wire ropes to 90-110 kg. Lock the turnbuckles with KO-K1 wire.

Notes: 1. The difference in tension of the wire rope lines should not exceed 10 kg.
2. With the tail gear box rod placed in mid-position the difference in length of the chain ends should not exceed 30 mm.

13. Connect the lugs of electric wires to the tail light and attach the wires in the fin beam with clamps.

Install the tail light where it belongs and screw it to the fixed rudder.

14. Couple the plug connectors to H10-3, CT-1 and H-1 transmitters. Tighten up the plug connector union nuts and lock them with KO-K1 wire.

15. Open the top fairing access panel, screw off breather 3 (Fig.133) and fill new hypoid gear oil into the gear box through the breather hole. Check the oil level by oil dipstick 1 (Fig.135). Screw the breather into the gear box housing. Secure the oil dipstick and the breather with KO-K1 lock wire.

16. Check adjustment of the foot control system as set forth in Section 3, Chapter V "Adjustment of Tail Rotor Control System".

17. Check the removal and installation area, see that there are no foreign objects and mechanical damage and make sure that all the parts are correctly installed and reliably locked.

18. Start the engines and check operation of the tail gear box by the readings of the respective instruments and make sure that the tail gear box oil system is leak-proof.

19. Install access lid 4 on the tail gear box housing. Tighten up the attachment stud nuts and fasten them one to another with KO-K1 lock wire.

20. Using access panel 1 on the fixed rudder, attach upper panel 10 on the fin beam for access to the tail gear box transmitters (Fig.134).

21. Secure all the access panels on the fin beam and on the fixed rudder.

XVIII. REPLACEMENT OF AB-63B TAIL ROTOR HUB AND BLADES

(1) Removal of AB-63B Tail Rotor Blades

1. Shift protective rubber jackets 24 from slip rings 23 towards the plug connectors and uncouple the plug connectors (Fig.136).

2. Unlock and turn off six nuts 13 of bolts 12 attaching protective ring 10. Remove the bolts and shift the ring to the rotor hub housing.

3. Unlock and turn off the nuts of the terminals and disconnect the wires which connect the contact rings with the heating elements of the blades.

4. Unlock and turn off the screws attaching the clamps with the wires and the protective diaphragm to the housing of contact rings 7.

5. Pull the wire ends from rubber rings 14 of the protective diaphragm and shift the diaphragm towards the rotor hub housing.

6. Unlock and turn off the screws attaching the clamps to the rotor hub housing as well as the screws attaching the heating cover plates to the sleeve and the end piece.

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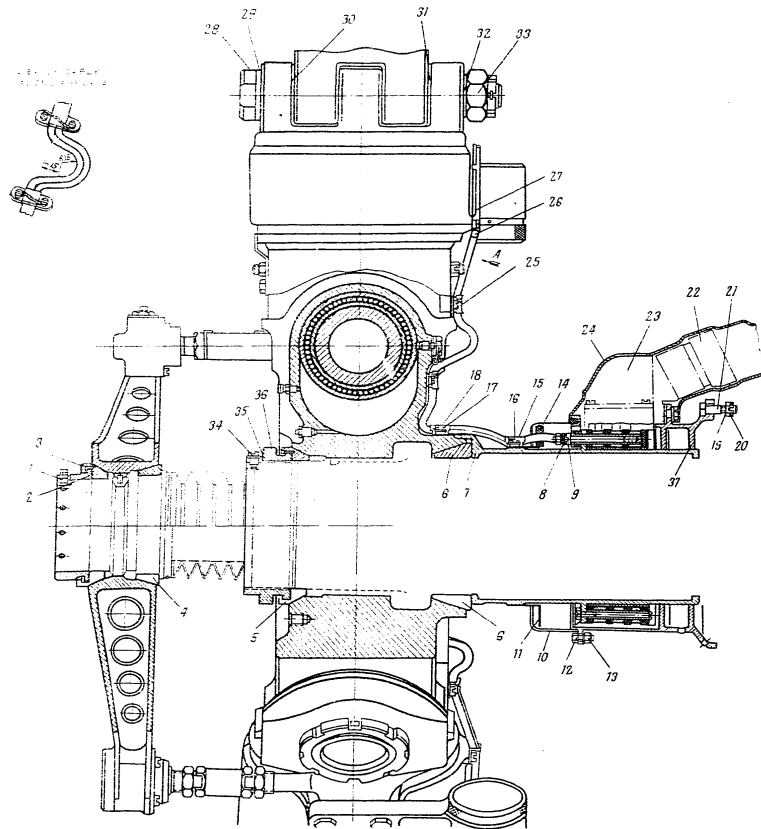
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FIG. 136, V4-53, TAIL ROTOR HUB

1 - retaining pin; 2 - nut of spider cone; 3 - spider front cone; 4 - spider rear cone; 5 - front cone of hub body; 6 - rear cone of hub body; 7 - assembly of contact rings; 8 - lock washer; 9 - contact bolt; 10 - protective ring; 11 - protective diaphragm; 12 - protective ring attachment bolt; 13 - nut of protective ring attachment bolt; 14 - protective diaphragm rubber ring; 15 - electric wire attachment clamp; 16 - clamp attachment screw; 17 - clamp attachment screw; 18 - electric wire attachment clamp; 19 - washer of protective shroud attachment bolt; 20 - nut for protective shroud attachment bolt; 21 - protective shroud attachment bolt; 22 - plug connector; 23 - slipping; 24 - rubber jacket of slipping casing; 25 - electric wire attachment clamp; 26 - electric wire; 27 - cable protection fitting; 28 - blade attachment bolt; 29 - washer of blade attachment bolt; 30 - lead-plated bronze washer; 31 - lead-plated bronze washer; 32 - washer of blade attachment bolt; 33 - nut of blade attachment bolt; 34 - retainer screw; 35 - retainer; 36 - rotor front cone nut; 37 - protective shroud.

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Free the wires of the heating cover plates from the clamps and install the clamps in their respective places to preclude their loss.

7. Unlock and turn off the nuts of the blade attachment bolts and disconnect the blades from the sleeves. Remove washers, withdraw the bolts together with washers from the eye-lugs of the sleeves and the end pieces of the blade roots, take off the lead-plated bronze set washers and remove the blades.

- Notes: 1. Blades removed from the sleeves should be kept only on storage containers or in special boxes.
2. Metal end pieces of blade roots as well as blade attachment bolts should be coated with mineral oil.
3. Blades should be shipped for repairs or storage only in special boxes.

(2) Installation of Blades on Tail Rotor Hub

Lead-plated bronze washers are placed between the extreme eye-lugs of the sleeves and end pieces of the blade roots. Since these washers may become damaged during installation of the blades on the rotor hub which is vertical (when installed on the helicopter) it is recommended to install the blades on the tail rotor hub when the rotor hub is placed horizontally on the ground.

To install the blades, proceed as follows:

1. Fix the rotor hub with a pin or place on a bench.
2. Check condition of the eye-lugs of the blade sleeves and end pieces. The eye-lugs of sleeves and end pieces should be free from dents and burrs. In case of minor dents or burrs due to careless handling of the blade end piece or the sleeve, polish the defective spots with sand paper. The eye-lugs of the sleeves and end pieces are cadmium plated and the dents and burrs should be polished off so that the cadmium plating is not removed from adjacent areas free from dents. After polishing wipe the eye-lugs thoroughly with a dry clean cloth. Coat the polished spots with transparent varnish.
3. Put protective jackets on the blades.
4. Each blade should be installed in conformity with assembly numbers branded on the blade root end piece and the sleeve.
Install the blade so that the holes in the eye-lugs of the sleeve and the blade root end piece coincide. To match the holes in the eye-lugs of the sleeve and the blade root end piece insert a mandrel in one eye-lug and a bolt in the other.
Then withdraw the mandrel and place lead-plated washer 31 between the extreme eye-lug of the sleeve and the blade root end fitting from the sleeve side. The washer is to be held by a tab.

Note. Lead-plated washers are installed in conformity with assembly numbers branded on the washer tab. The first (Arabic) figure of the assembly number corresponds to the number of the sleeve eye-lug, the second (Arabic) figure - to the number of the sleeve.

Install another lead-plated washer 31 between the second extreme eye-lug of the sleeve and the blade root end piece and align it with the mandrel.

If the washer moves with difficulty drive it home by a gentle stroke of a rubber hammer against the tab.

Remove the mandrel and install blade attachment bolt 2P. The bolt should be preliminarily fitted with a washer chamfered on one side round the hole. The chamfered side of the washer should face the bolt head.

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Remove the bolt from the second eye-lug and install lead-plated washers in a similar way. Align them with the mandrel, remove the mandrel and install the bolt together with the washer again.

Put washers 32 on the threaded ends of the bolts, install nuts 33 and tighten them with a torque of 30-35 kg-m. Lock the nuts with cotter pins, 3x60.

5. Perform operations contained in Item 4 to install the remaining blades.

6. Perform operations 12-19 of Section "Installation of Tail Rotor Hub" of the present Chapter.

(3) Removal

1. Unlock and drive out pin 1 retaining the nut of the spider front cone, turn off nut 2 and remove both halves of front centering cone 3.

2. Unlock and turn off attachment screws 34 of the retainer, remove retainer 35 and withdraw the retaining pin.

3. Turn off nut 36 of the rotor hub front cone and remove both halves of front centering cone 5.

4. Perform steps 1-6 contained in Section III ("Replacement of AB-63B Tail Rotor Blades").

5. Using the 50-9901-00 slings remove the rotor hub from the gear box shaft. When doing it, pay special attention to protection of the shaft thread from dents.

6. Remove rear centering cones 4 and 6 of the spider and the body.

7. Remove protective ring 10 and diaphragm 11 of the slip ring.

8. Unlock and turn off the bolts attaching the collectors to the protective shroud.

Remove the collectors and adjusting shims. Install the collector attachment bolts together with adjusting shims and washers on the removed collectors so that they are not lost.

9. Remove assembly housing 7 of contact rings from the front end of the gear box shaft.

Note. Install screws and clamps together with the protective diaphragm on the housing of contact rings so that they are not lost.

10. Remove cotter pins and turn off nuts 20 of six bolts 21 attaching protective shroud 37, take off washers 19 and withdraw the bolts.

11. Remove protective shroud 37 from the gear box shaft (install the removed bolts on the protective shroud so that they are not lost).

Notes: 1. The housing with the contact rings and the collector assembly with the protective shroud should be removed only for inspection or during replacement of the tail rotor hub.
2. When the tail rotor hub is to be shipped for repair or storage, it should be packed in a special container. The tail rotor hub should be shipped complete with parts and tools required for installing it on the tail gear box shaft.

(4) Installation

CAUTION. The tail rotor hub should be installed on the helicopter with the blades attached.

1. Mount the protective shroud on the tail gear box housing and see that the shroud drain holes are directed down. Install six bolts attaching the shroud to the

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gear box housing, fit the 3402A 1.5-8-14 washers, screw up and tighten the 3336A8 nuts and lock them with cotter pins, 2x25.

Note. The nuts should be tightened uniformly and in a crosswise manner.

2. Mount the assembly of contact rings on the gear box shaft.
3. Install the protective diaphragm on the housing of the contact rings. Before doing it make sure that the diaphragm is fitted with four pieces of the EV-273 rubber rings. Mount the protective ring. Do not fix the above parts permanently.
4. Lubricate the rear centering cones of the hub body and the spider with mineral oil and install them on the gear box shaft and the slide, respectively.
5. Using a crane and the 50-9901-00 slings lift the hub to the level of the tail gear box shaft (the splines of the shaft, spider, hub body and the slide should be lubricated with mineral oil). Carefully place the rotor hub on the splines of the gear box shaft. During the installation procedure remember the following recommendations:
 - (a) prior to installation of the hub, screw up a nut on the slide so as to protect the slide thread from dents;
 - (b) during installation of the hub on the gear box shaft see that the cut-off spline in the hub body coincides with the pin pressed between two splines of the gear box shaft;
 - (c) the cut-off spline of the spider should coincide with the pin pressed between two splines of the slide shaft as described in Item b;
 - (d) see that the slot of the rotor hub body coincides with the projection on the housing of the contact rings; it may be achieved by turning the housing of the contact rings round its axis;
 - (e) turn the hub body on the shaft through one complete revolution to make sure that the rotor hub body is not in touch with the protective shroud;
 - (f) the rotor hub should move by a hand effort on the whole length of the splines until it bears against the rear cone.
6. Put both halves of the front centering cone on the flange of the rotor hub attachment nut and lubricate the nut thread and the cone with mineral oil.
7. Lubricate the thread of the gear box shaft with mineral oil, screw up the rotor hub attachment nut together with the cone installed on the gear box shaft and tighten it with a torque of 140-170 kg-m.
8. Lock the rotor hub attachment nut by inserting a retaining pin into one of the gear box shaft holes matched with the nut slot. Install a retainer holding the pin from falling out, fix it with two screws, lock the screws in pairs with KO-1 mm wire.

CAUTION. The holes of the gear box shaft should be aligned with the nut slot only by tightening of the nut. Never back off the nut to align the hole with the slot!

9. Lubricate the slide nut thread and the front centering cone of the spider with mineral oil and place both halves of the cone on the slide nut flange.
10. Lubricate the slide thread with mineral oil and screw up the spider nut (together with the installed cone) on the slide thread. Tighten up the nut with a torque of 100-120 kg-m.
11. Lock the nut by matching one of the slide holes with the nut slot and install a retaining pin. Fix the pin with a cotter pin, 2x10.

CAUTION. The holes of the slide should be matched with the nut slot only by tightening of the nut. Never back off the nut to match the hole with the slot.

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12. Fix the blades with the clamps, sleeves and blade root end pieces by means of clamps and cover plates.

The clamps and cover plates are fastened with screws, 6x1, locked in pairs with KO-K1 mm wire.

During attachment of wires it is necessary to lay them in loops between the clamps, between the clamp and the cover plate so that the blade together with the sleeve may turn with respect to the sleeve axis and the clamp with respect to the fulcrum pin (see Fig.136. View along arrow A).

13. Connect the ends of the wires running from the blade heating elements by means of contact ring terminals (two wires for each blade). Before connection pass the wire ends through the PV-273 rubber rings attached to the protective diaphragm.

One wire of the blade heating element is connected to terminal K-1 and the other - to terminal K-2. After connection of the wires lock the terminal nuts in place by bending a tab of each retainer to the terminal nut.

14. Using a test lamp make certain that the de-icing system wires have been connected correctly.

15. Fix the wires together with the protective diaphragm to the housing of contact rings. The wires are fixed with clamps which are attached to the housing of contact rings with screws.

The screws are locked in pairs with KO-K1 mm wire.

16. Attach the protective ring to the protective shroud with six bolts. Place washers under the nuts. Lock the nuts with cotter pins, 1.5x20.

17. Install the collectors. Each collector is fastened to the protective shroud with three bolts. Place washers under the bolt heads.

During installation of the collectors see that the brushes (fitted in the collectors) coincide with the contact rings. This is achieved by selection of shims placed between the collectors and the protective shroud.

After final installation of the collectors lock the bolts with KO-K1 mm lock wire.

18. Install plug connectors and put rubber jackets on the collectors.

19. Check the setting angles of the blades with the pedals set in the extreme positions.

VIX. REPLACEMENT OF STABILIZER

(1) Removal

1. Disconnect the bending jumpers and the stabilizer control link-rod from the stabilizer so that the length of the link-rod remains unchanged.

2. Remove the clamps attaching the sealing jackets to the stabilizer spar, unlace the jackets and put rubber mats on the jackets (under the spar).

3. Remove the bands made of AK-100 material which cover the protection openings in the stabilizer spar used for access to special bolts 4 (Fig.137) and bolts 2 attaching jointing plate 1 to the left half of the stabilizer.

4. Unlock, turn off and withdraw the attachment bolts, detach the stabilizer from the tail boom fittings and lower it onto rubber mats.

5. Remove cotter pins and turn off the nuts of the bolts attaching the jointing plate to the left half of the stabilizer and withdraw the bolts.

6. Remove cotter pins, turn off the nuts of the bolts jointing the stabilizer halves, withdraw the bolts and take away the stabilizer halves.

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(2) Installation

1. Install the stabilizer by reversing the removal procedure.
2. Before installing the stabilizer on the helicopter deprocess the fittings attaching the stabilizer to the tail boom and the attachment fitting of the stabilizer control link-rod.
3. During the installation procedure lubricate the attachment fittings and bolts as well as the attachment bolt of the stabilizer control link-rod with UMATM-201 grease.
4. Exercise care while installing the stabilizer attachment bolts, avoid applying strong blows to them so that the nuts installed on the stabilizer attachment fittings (on the tail boom) are not cocked.
5. Cotter-pin the stabilizer jointing bolts only after tightening the attachment bolts and checking the stabilizer for proper rotation in the attachment fittings. The stabilizer should rotate smoothly, without jerks or binding.
6. After the installation procedure adjust the stabilizer control system as specified in Section "Adjustment of Helicopter Control System".
7. After adjustment of the stabilizer control system check the total play in the control linkage. The play is determined by measuring the deflection of the stabilizer trailing edge which should not exceed 3 mm.
8. Close the production openings in the stabilizer spar with bands made of AM-100 material and attach the latter with AK-20 glue.

XX. INSTALLATION AND REMOVAL OF WING

(1) Removal

1. Remove the fuel system vent pipes from the wing fillet lower portion on the fuselage right side.
2. Turn off the screws attaching the post of the beam aerial of the V.H.F. communication radio set to the wing, remove the post and fold up the aerial.
3. Turn off the screws attaching the wing fillet to the fuselage and remove the fillet.
4. Disconnect the electric wires of the formation and navigation lights from the wing.
5. Remove plugs from the lifting sockets of the outer wing, install eye-bolts instead, engage the eye-bolts with the hooks of wing lifting slings (Dwg.50-9901-770), and using a crane, slightly tighten up the lifting slings.
6. Unlock the bolts attaching the strong box of the outer wing to the centre-section spar, drive out the bolts and remove the outer wings.
7. Install wooden supports under the centre-section spar.
8. Disconnect the actuator rod of the wing control mechanism from the centre-section spar so that the actuator rod length is not disturbed.
9. Unlock and turn off the nuts of the bolts attaching the centre-section spar to the fuselage fittings and remove the centre-section spar.
10. Process the joint surfaces of wings and centre-section spar, joint plates and attachment parts with gun lubricant, then wrap the joint surfaces of wing and centre-section spars in bitumen paper.

(2) Installation

1. Installation of the wing is the reverse of removal.
2. Before installing the outer wing, deprocess the jointing flanges of the centre-section spar and the wing strong box.

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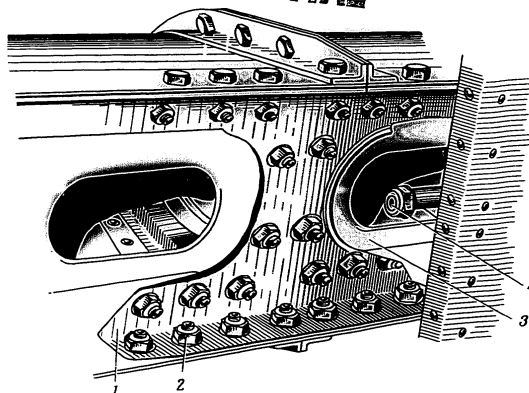
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FIG. 137. JOINTING STABILIZER HALVES
1 - jointing plate; 2 - jointing plate attachment bolt; 3 - right half of stabilizer; 4 - jointing bolt.

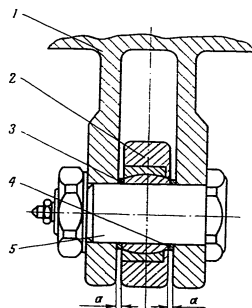


FIG. 138. ATTACHING CENTRE-SECTION SPAR TO FUSELAGE
1 - centre-section spar fitting; 2 - fuselage fitting; 3, 4 - spacer rings; 5 - bolt.

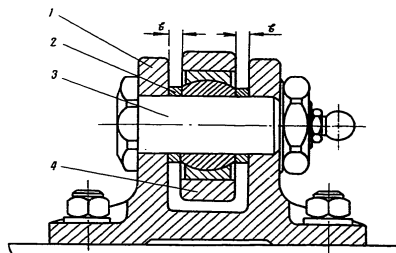


FIG. 139. ATTACHING FMK-1 WING CONTROL MECHANISM ROD TO CENTRE-SECTION SPAR FITTING
1 - centre-section spar fitting; 2 - spacer ring; 3 - bolt; 4 - eye lug of wing control mechanism rod.

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3. During the installation procedure the bolts jointing the centre-section spar to the strong box of the outer wing

should be placed so that their heads are inside the fuselage. The bolt heads should be fitted with new lock washers.

4. After installing the centre-section spar check clearance "a" between the fuselage fittings and the ~~previously removed~~ centre-section spar and clearances "b" between the fitting of the centre-section spar and the eye-lug of the actuator rod of the wing control mechanism. Clearances "a" and "b" should be within 1.5-4 mm and 2-4 mm, respectively (see Figs 138 and 139).

5. The wing angles of incidence should be checked by means of a protractor and a special appliance (Dwg. 50-9715-200) for installing the protractor on the wing. The appliance should be placed along the axis of rib No.16.

The wing incidence angles are adjusted by screwing the actuator rod eye-lug of the wing control mechanism in or out.

6. After installation of the wing fillets it is necessary to check clearances between movable and fixed parts. The clearances should be not less than 5 mm.

7. Inject LMATM-201 grease into the oil cups of the jointing fittings of the centre-section spar and the attachment fitting of the wing control mechanism actuator rod.

XXI. REPLACEMENT OF PB-1 HYDRAULIC UNIT

(1) Removal

1. Bleed the pressure from the hydraulic system and drain off AMF-10 oil.
2. *Remove the cowls tail portion cover, upper panels and cowls gear box portion frame.*
3. Disconnect electric wires, piping and hoses of the hydraulic system from the hydraulic unit components. Plug the ends of piping and hoses.
4. Attach the wire rope to eye-bolts of the hydraulic unit housing and slightly lift the hydraulic unit with a crane.
5. Unlock and turn off the nuts of the bolts attaching the hydraulic unit housing to the fuselage fittings, pull out the bolts and remove the hydraulic unit.

(2) Installation

1. Install the hydraulic unit by reversing the removal procedure.
2. Before installation of the hydraulic unit components on the helicopter deprocess them and plug the pipe unions of the components.
3. The clearances between the pipes and the elements of the helicopter structure should be not less than 3 mm.
Place 0.5-mm thick sheet rubber pieces under the pipe attachment clamps.
4. Sew dermateen jackets for the hoses of the hydraulic system in spots where the hoses touch the elements of the helicopter structure.
5. Lock and seal all connections coupling the pipes and hoses to the hydraulic unit components.
6. *Fill main and duplicating hydraulic system reservoirs with AMF-10 oil and test the helicopter hydraulic system in accordance with the "MH-6 Helicopter Operating Instructions."*

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XXII. REPLACEMENT OF UPPER FUEL TANKS

(1) Removal

1. Drain fuel from the upper fuel tanks.
2. Remove hatch cover 13 and the tail fairing of cowl 15 (Fig.75). Working through the hatches giving access to the fittings installed on the upper wall of tank No.11, disconnect the filler neck hose, electric wires of fuel contents gauge transmitters and the fuel transfer pipe, vent system pipe and the inert gas system pipe.
- Plug the pipe ends.
3. Unlock and remove the bolts attaching the plate of tank No.11 to the upper wall of the tank container.
4. Open the access panels and turn off the lock nuts and nuts of the pins attaching tank No.11 to the upper wall of the tank container.
5. Remove the hatch covers for access to the fittings installed on the upper walls of tanks No.9 and No.10 and disconnect the filler neck hose (from tank No.10), electric wires of the fuel contents gauge transmitters and the piping of the vent system and the inert gas system.
- Plug the pipe ends.
6. Unlock and remove the bolts attaching the plates of tanks No.9 and No.10 to the upper walls of the tank containers.
7. Open the access panels and turn off the lock nuts of the pins attaching tanks No.9 and No.10 to the upper walls of the tank containers.
8. Remove service panels, open the hatch doors on the cargo compartment ceiling which provide access to the fittings installed on the lower walls of upper tanks and perform the following operations:
 - disconnect the fuel system pipe, electric wires and vent pipes from the NHB-2 pump (on tank No.11) and unit 463 (on tank No.9) and remove the pumps;
 - remove the pipes and durite hoses connecting tank No.10 with tank No.9;
 - disconnect the electric wires from the fuel level warning units;
 - remove the bolts attaching the tanks to the lower walls of the containers.
9. Turn off the screws attaching the container covers of tanks No.9 and No.10 to frame No.26 and remove the tanks from the containers.

(2) Installation

1. Install the upper fuel tanks by reversing the removal procedure.
2. Tighten up the bolts attaching the accessories to the fuel tanks with a torque wrench adjusted for $M_{torque} = 30 \text{ kg-cm}$. Install the bolts on EV grease.
3. During adjustment of the fuel level warning units for the required level (not more than 50 litres) it is allowed to place gaskets up to 10 mm thick (Д16 AT material) under the flange of the fuel level warning units.

XXIII. REPLACEMENT OF EXTERNAL FUEL TANK

(1) Removal

1. Drain fuel from the external fuel tank.
2. Unlock and disconnect the fuel hose and the vent pipe from the external tank and plug their ends.

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3. Fix the external tank mounting appliance (Dwg. H9906-100) on the diagonal attachment brace of the tank and attach the tank.
4. Unlock and disengage the strap bands of the external tank and remove the tank.

(2) Installation

1. Install the external fuel tank by reversing the removal procedure.
2. While installing the external fuel tank, pay attention to the condition of felt padding placed between the mounting seats and the tank.
If the felt padding is badly worn out, it should be replaced with new one. The felt padding is secured to the mounting seats with glue No.88
3. The clamping bolts of the tank attachment bands should be tightened up with $M_{torque} = 650 \text{ kg-cm}$.

XXIV. REPLACEMENT OF FMK-1 WING CONTROL HYDRAULIC
 MECHANISM

(1) Removal

1. Turn off screws 1 attaching the nose section of wing fillet 2 (Fig.105) and remove the fillet.
2. Place wooden blocks under the centre-section spar to fix the wing in the required position.
3. Disconnect the vent pipes and hoses of the hydraulic system from the hydraulic mechanism and plug their ends.
4. Measure and record the distance between the axes of centre-section spar fitting 1 and fuselage fitting 6 (Fig.140).
5. Disconnect the hydraulic mechanism from the fittings on the centre-section spar and the fuselage and remove the hydraulic mechanism from the helicopter.
6. Process the hydraulic mechanism as specified in the respective instructions.

(2) Installation

1. Install the FMK-1 wing control hydraulic mechanism by reversing the removal procedure.
2. Deprocess the hydraulic mechanism before installing it on the helicopter.
3. During the installation procedure adjust the length of the actuator rod so that the previously measured distance between the axes of the fittings on the centre-section spar and the fuselage is not disturbed.
4. In the course of assembly, coat the pipe union thread of the hydraulic mechanism with MPC grease.
5. Before installation blow the pipes and hoses of the hydraulic system with compressed air.
6. After installation check functioning of the hydraulic mechanism and make sure there are no leaks in connections by engaging the main and duplicating hydraulic systems.
7. Check the wing angles of incidence in two positions as specified in Item 5, Para (2), Section XX.

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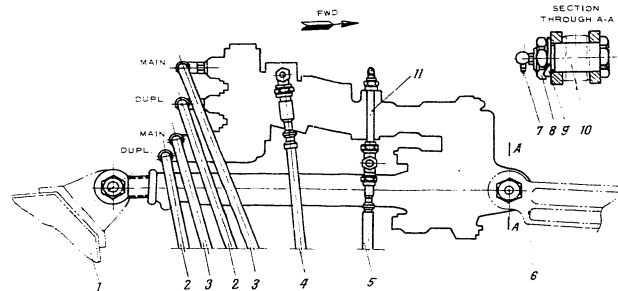
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FIG. 140. INSTALLATION OF FMK-1 WING CONTROL MECHANISM

1 - centre-section spar fitting; 2, 3, 4 - duplicating hydraulic system hoses; 5 - main hydraulic system hoses;
 6, 11 - vent hose and pipe; 7 - fuselage fitting; 8 - oil cup; 9 - nut; 10 - lock washer; 11 - bolt.

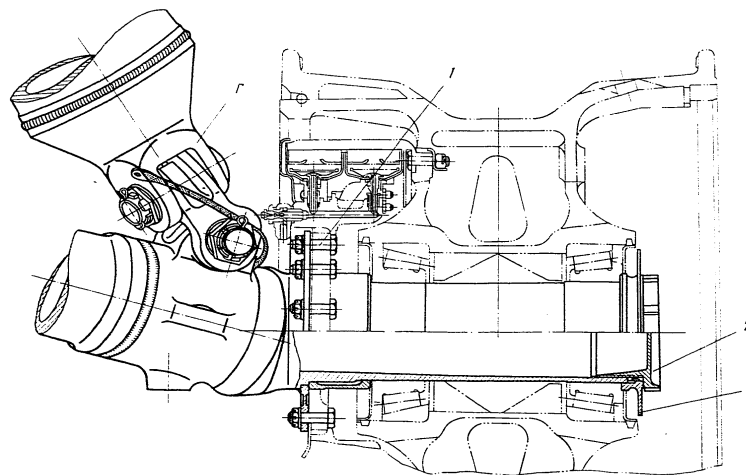


FIG. 141. MAIN LEG AXLE WITH ATTACHMENT FITTING FOR TWO-CHAMBER SHOCK STRUT

1 - brake housing attachment bolt; 2 - wheel attachment nut; 3 - flange; 4 - fitting for attachment of two-chamber shock strut to axle.

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XXV. REPLACEMENT OF LANDING GEAR

(1) Removal of Main Leg

A. Removal of Wheel

1. Disconnect the hose of the air system from the wheel brake.
2. Install the hydraulic jacks and lift the helicopter by 240 mm (until the inner tubes of the high-pressure chambers are extended), relieve the nitrogen pressure in the shock strut chambers to zero and close the throttling valves.
3. Unlock and turn off nut 2 attaching the wheel to the axle (Fig.141).
4. Remove flange 3 (Fig.141) and the wheel from the axle. Removal of the wheel should be performed by means of a puller (Dwg. No.B9909-200).
5. Remove the cotter pins from bolts 1 (Fig.141) attaching the brake housing to the flange of the wheel axle, turn off the nuts, withdraw the bolts and remove the brake.

B. Removal of Shock Strut, Brace and Axle

6. Disconnect the pipe of the air system from the shock strut, plug the pipe ends, wrap them with cellophane and tie with twine.
7. Disconnect the hoses and pipe 6 (Fig.142) of the hydraulic system from the axle and the shock strut. Plug the pipe ends, wrap up with cellophane and tie with twine.
8. Turn off the screws attaching the panels to the fairings of the shock strut, brace, and the axle and remove the panels.
9. Remove cotter pins and turn off the nuts of the bolts attaching the clamps which fasten the fairing ends of shock strut, brace and the axle, pull out the bolts and remove the caps from the fairing ends.
10. Remove cotter pins, turn off the nuts of the bolts attaching the clamps of the fairings, pull out the bolts and remove the fairings of the shock strut, brace, and the axle.
11. Remove cotter pins of the bolts attaching the shock strut, brace, and the axle to the fuselage fittings.
12. Remove cotter pins of the bolts which joint the link-rod and the attachment brace of the external tank to the bolt securing the shock strut cardan shaft to the fuselage fitting, put a support under the external tank, withdraw the bolts and move aside the link-rod and the brace.
13. Remove cotter pins of the bolts attaching the shock strut and the brace to the axle fittings.
14. Turn off the nuts, withdraw the bolts attaching the shock strut to the fuselage and axle fittings and remove the shock strut using lifting slings (Dwg. 638/0083).
15. Turn off the nuts, withdraw the bolts attaching the brace to the fuselage and axle fittings and remove the brace
16. Turn off the nut, remove the bolt attaching the axle to the fuselage fitting and remove the axle.

(2) Removal of Nose Leg

1. Install the hydraulic jacks and lift the helicopter until shock strut inner tube 5 (Fig.143) is fully extended and relieve the nitrogen pressure in the shock strut.

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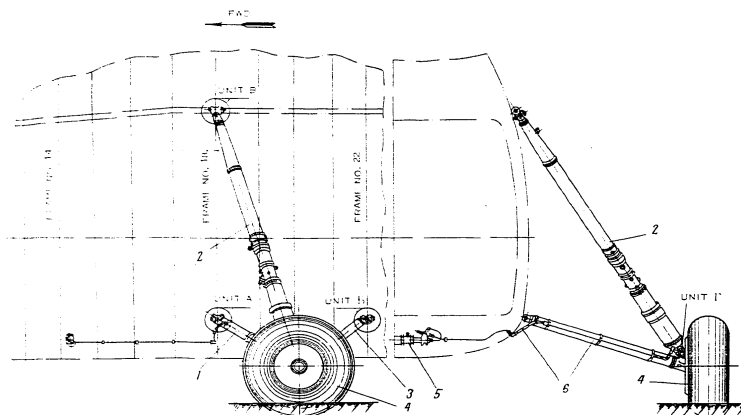


FIG. 142. MAIN L.G. LEG

1 - axle; 2 - two-chamber shock strut; 3 - brace strut; 4 - wheel; 5 - spring-type damper; 6 - pipe.

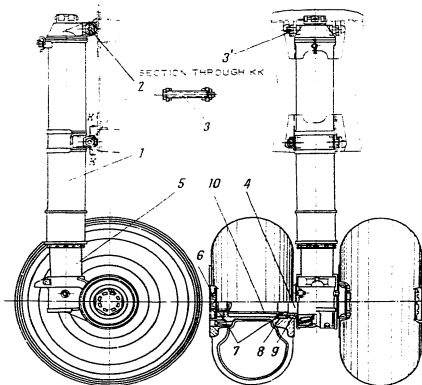


FIG. 143. NOSE LEG WITH WHEELS

1 - outer tube; 2 - attachment fittings; 3 and 3' - attachment bolts; 4 - axle with wheels; 5 - inner tube; 6 - nut; 7, 9 - sleeves; 8 - dowel pin; 10 - spacer sleeve.

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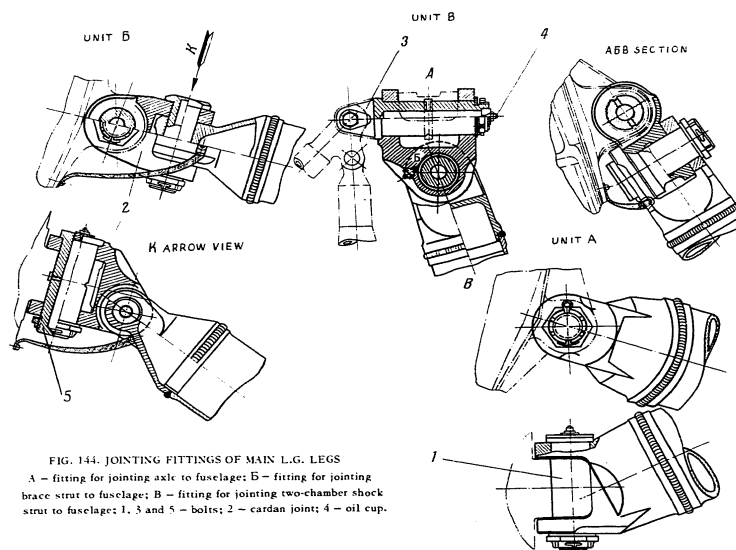


FIG. 144. JOINTING FITTINGS OF MAIN L.G. LEGS
 A - fitting for jointing axle to fuselage; B - fitting for jointing
 brace strut to fuselage; 1, 3 and 5 - bolts; 2 - cardan joint; 4 - oil cup.

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2. Unlock and turn off the retaining bolts and remove wheel attachment nuts 6 (Fig.143).
3. Remove the wheel and spacer sleeve 10 from the axle (Fig.143).
The wheels should be removed by means of a puller (Dwg. 50-9909-400).
4. Remove cotter pins of bolts 3 and 3 which attach the shock strut to the fittings of fuselage frame No.1, turn off the nuts, withdraw the bolts and remove the nose shock strut.

(3) Installation of Main and Nose Legs

1. Install the main and nose legs of the helicopter by reversing the removal procedure.
2. Before connection of the air and hydraulic pipes to the landing gear purge them with compressed air. During the assembling procedure coat the threaded connections of the pipes with MPC grease.
3. Prior to installing the main and nose wheels, pack the roller bearings lavishly with HK-50 grease. The nose wheels should be installed by means of a special appliance (Dwg. 50-9909-450).
4. Nuts 2 (Fig.141) which attach the wheels to the axles should be tightened up while the wheels are rotating. Discontinue tightening when the wheel stops rotating, back off the nut by 1/6 of a turn and lock it in this position.
The wheels installed on the axle should readily rotate when driven by hand. When the wheel is rocked in the plane of its rotational axis, a slight end play should be felt in the roller bearings.
5. After installation of the main wheels check functioning of the brakes and synchronous braking of the wheels.
6. The nuts of bolts 1, 3 and 5 (Fig.144) should be tightened up so that the hinges move without binding.
7. The assembly of the landing gear over, inject LUKATIM-201 grease in all hinged joints.

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A P P E N D I X 1

CARE OF JMT-3 MOTOR-DRIVEN WINCH

Regular checks of condition of the motor-driven winch add to reliability of its operation.

1. When in service check periodically the following:

- (a) cleanliness of the exterior surfaces of the motor-driven winch and absence of visible damage;
- (b) reliability of its attachment, presence of attachment bolts and condition of locking devices;
- (c) condition and attachment of power supply receptacles of the electric motors and the box of end switches.
- (d) condition of the wire rope, especially after towing a load with an effort exceeding 500 kg.

CAUTION. In case one of the strands is broken the wire rope should be replaced.

2. During ground testing of the winch it is recommended to apply an effort of about 25 kg to the wire rope so that the wire rope is wound up correctly.

3. Use of the hand drive of the winch is allowed only with the de-energized motors. In this case the effort applied to the handle should not exceed 16 kg (when the handle arm is 150 mm long).

(1) Installation of Motor-Driven Winch on Helicopter

1. Prior to installing the motor-driven winch check the following:

- (a) by visual inspection - absence of mechanical damage;
- (b) with the winch placed in cold dry conditions - insulation of the electric motors which should be not less than 20 megohms;
- (c) adjustment of the wire-rope layer speed control box to suit the diameter of the wire rope.

2. Install the motor-driven winch in place and reliably fasten it with attachment bolts.

3. Connect the motor-driven winch to the electrical mains of the helicopter by inserting the plugs into the plug connectors of the electric motors and the box of the end switches. See that the electric motors are connected correctly.

This is checked by disengagement of the plug connector of each motor and setting a respective toggle switch in position for release of the wire rope.

In case the electric motors are energized separately and the wire rope is released by each motor, it indicates that the motors are connected to the helicopter circuit correctly and may be energized simultaneously.

CAUTION. Never switch the electric motors for rotation in opposite directions.

(2) Replacement of Wire Rope

1. Replacement of worn-out wire rope is done as follows:

- (a) engage the winch for release of the wire rope and pull it out with an effort ensuring its tightness till the release end switch operates. The remaining 2-4 turns of the wire rope should be unwound by means of the hand drive so that the wire rope end fixed in the bead slot is exposed. Back off the screws attaching the bar to the

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carriage of the wire rope layer, withdraw the wire rope end together with the ball from the bead slot and remove the wire rope;

(b) turn off 8 bolts, measure the diameter of the newly installed wire rope, remove the cover of the winch gear box and set the gears in accordance with the diameter of the newly installed wire rope. If the wire rope diameter measures from 4.95 to 5.1 mm, it is necessary to install the dowel pin of the third gear in the hole of the third (as viewed from the wire rope outlet side) gear of the gear box.

If the wire rope diameter is from 5.1 to 5.25 mm, it is necessary to install the dowel pin of the first gear in the hole of the first (as viewed from the wire rope outlet side) gear of the gear box.

If the wire rope diameter is from 5.25 to 5.4 mm, the dowel pin of the second gear should be installed in the hole of the second gear of the gear box.

CAUTION. To avoid breakage, do not join two gears with dowel pins until the dowel pin used earlier for joining of other gears is removed;

(c) install the cover of the winch gear box in place, tighten up 8 bolts and lock them in pairs with KO-0.8 wire;

(d) pass the wire rope under the bar of the wire rope layer, drive in and lock the screws of the bar. Insert the ball of the wire rope end in the bead slot and wind up the same length of the wire rope left after disengagement of the end switch that was actuated by the old wire rope (2-4 turns).

Tighten up the wire rope, press the wire rope turns tightly to each other and switch on the motor-driven winch for rope retraction, with a 25 kg load applied to the wire rope. The wire rope is wound up until the retraction end switch installed on the winch operates. Then set the winch switch for rope release, fully uncoil the wire rope until the end switch operates and make sure that 2-4 turns of the wire rope are left on the winch drum.

- Notes:
1. Release and retraction of the wire rope should be performed only with use of one motor.
 2. If there is no wire rope on the winch drum, use of the hand drive is not allowed.
 3. The uniformity of laying of a newly installed wire rope depends on correct selection of the laying pitch as well as on the quantity of wire rope turns. Therefore the uniformity of wire rope laying round the drum should be checked by check winding of 1-2 rows of the wire rope. In case of missing turns it is necessary to add an extra turn to 2-4 turns of the wire rope left on the drum. In case of overlapping reduce the number of turns left on the drum by one turn.

(3) Replacement of Broken Wire Rope

In case of the wire rope breaks the remaining length of the wire rope should be removed from the winch drum by engaging the winch for release with a 25 kg load applied to the wire rope, be sure to switch it off as soon as the wire rope is uncoiled to the fixed end so as to avoid winding of the wire rope round the drum in the reverse direction. After removal of the wire rope engage the winch again for release until the release end switch operates. Using the hand drive, revolve the drum from this position by 2-4 turns to release completely the wire rope.

Install the new wire rope as specified in Para 2, Items "b", "c" and "d" of the present Section.

Note. Check the uniformity of wire rope laying round the winch drum by test-winding of one or two rows of the wire rope. In case of missing turns add an extra turn to the turns (2-4) left on the drum during service. In case of overlapping reduce the number of turns left on the drum by one turn.

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Ми-6 HELICOPTER
powered by A-25B turbo-rotor engines

BOOK III

supplement I

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CONFIDENTIALINSTRUCTIONS ON USE OF NEUTRAL
GAS SYSTEM

1. PURPOSE

The purpose of the neutral gas system is to prevent formation of an explosive mixture of fuel vapours with the oxygen of the air in the helicopter fuel tanks.

The neutral gas system employs carbon dioxide (CO₂) kept in three eight-litre bottles arranged under the ceiling of the cargo compartment between frames No.27 and No.28.

The bottles, type OCV-5, are filled with 5.7 kg of liquid dehydrated carbon dioxide each. Discharge bonnets of the bottles are controlled remotely.

Note. If the helicopters are used in tropical countries where the ambient air temperature on the airfield reaches +50°C, it is recommended to decrease the bottle charge to 4.4-0.15 kg.

In case it is required to employ the neutral gas system, switch on the push-button switch of this system on the flight engineer's control panel. This results in explosion of the discharge cartridges of all the three bottles. The explosion causes the discharge bonnet locks to open and to direct the carbon dioxide gas in a gaseous state via a pipeline into the PB-50M gear box; further the gas flows at a somewhat lower pressure into the metering calibrated jet whence it is fed into the upper space of the fuel tanks at a still lower pressure. The gas fills the entire free space of the fuel tanks.

2. REPLACEMENT OF BOTTLES

After the bottles have been used up, replace them in the following sequence:

- (a) disconnect all the pipes from the bonnet locks. Plug up the pipe unions and the pipes;
 - (b) remove the fuzes from the bonnet locks and take out the waste discharge cartridges. Insert plugs instead of the fuzes;
 - (c) lock the lever of the bottle bonnet lock;
 - (d) release the bottle attachment collars and remove the bottle from the helicopter;
 - (e) examine a new charged bottle and make sure that it is in good condition and that the seals are in place;
 - (f) weigh up the bottle and check the weight of the charge. Make sure it weighs 5.7 ± 0.1 kg.
- At an ambient air temperature of +50°C the weight of the charge must be 4.4-0.15 kg;

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(g) put the bottle in place on the helicopter, remove the plugs from the pipe union and connect all the pipes;

(h) insert new discharge cartridges into the bonnet lock, make sure the lock circuit is deenergized, insert the fuses in their places, secure with a locking nut and tighten up the latter with a wrench as far as it will go; this done, safety the nut with wire.

Check the reliability of the fuze contacts with an ohmmeter;

(i) disconnect the locking device from the lever of the bottle bonnet lock.

3. CARE OF NEUTRAL GAS SYSTEM

(a) During helicopter service it is required to check the condition of the neutral gas system at regular intervals, paying special attention to the reliability of attachment of the pipelines and bottles, to condition of the plug of the warning unit which signals on functioning of the system, as well as to pressure - tightness of all connections;

(b) after every 50 flying hours, but not less than once every six months check the weight of the charge in the bottles.

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LOADING INSTRUCTIONS

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S e c t i o n I

GENERAL

1. INTRODUCTION

The present loading Instructions contain directions as to loading, locating and lashing down cargoes on helicopters, model Mh-6, and shall be used as a supplement to the book "Mh-6 Helicopter. Operating and Piloting Instructions".

For shipment operations, the helicopter is fitted with special equipment and with a set of removable handling and tie-down equipment which allow the helicopter to carry various types of loads.

For the detailed description of the helicopter, its airborne equipment and performance characteristics refer to the book "Mh-6 Helicopter. Description".

2. CARGO COMPARTMENT

The cargo compartment is located between frames Nos 1 - 26 and ends in cargo loading doors which cover the entire width of the cargo compartment. This makes it possible to load the cargo compartment with bulky cargoes.

For the general layout and dimensions of the cargo compartment of the Mh-6 helicopter see Fig.1.

Loads are arranged in the compartment through reference to white longitudinal lines painted on the cargo compartment floor and the ramps:

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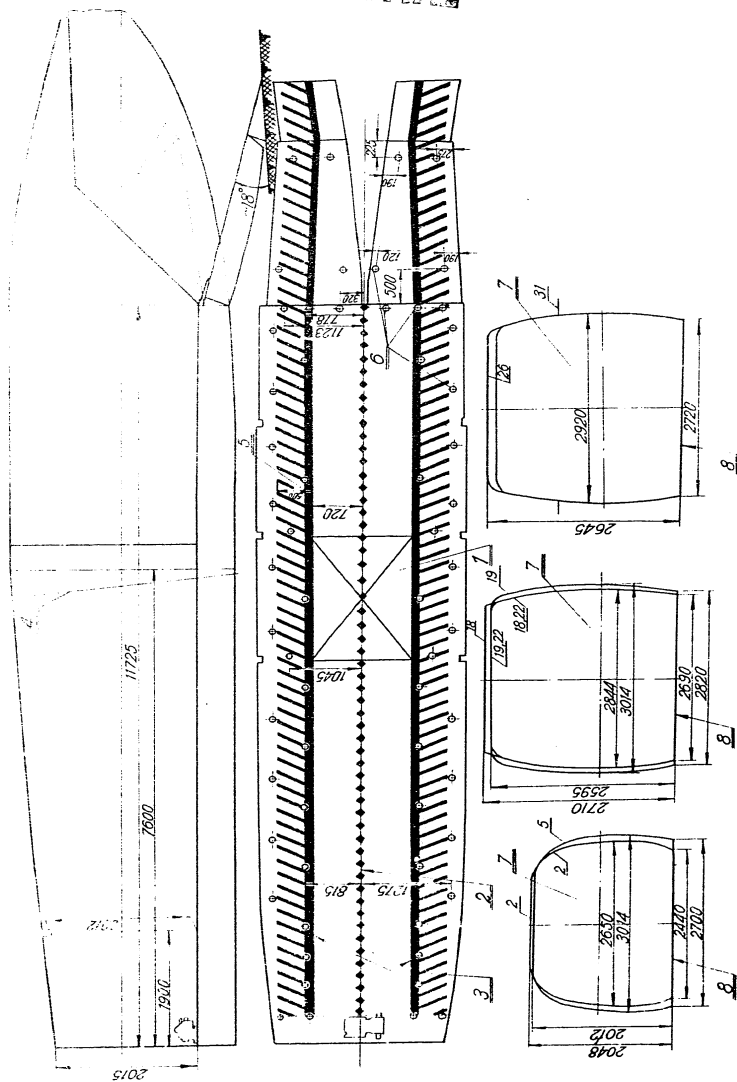


FIG. 1. GENERAL LAYOUT AND DIMENSIONS OF CARGO COMPARTMENT OF MIL-6 HELICOPTER

1 - cargo bay; 2 - symmetry axis of helicopter on non-stressed portion of floor; 3 - stressed beam of floor assembly; 4 - axis of main rotor; 5 - stressed portion of floor; 6 - tie-down rings; 7 - transverse sections through fuselage (inner contours shown); arrow with figure at contour line identifies the number of respective frame; 8 - floor line.

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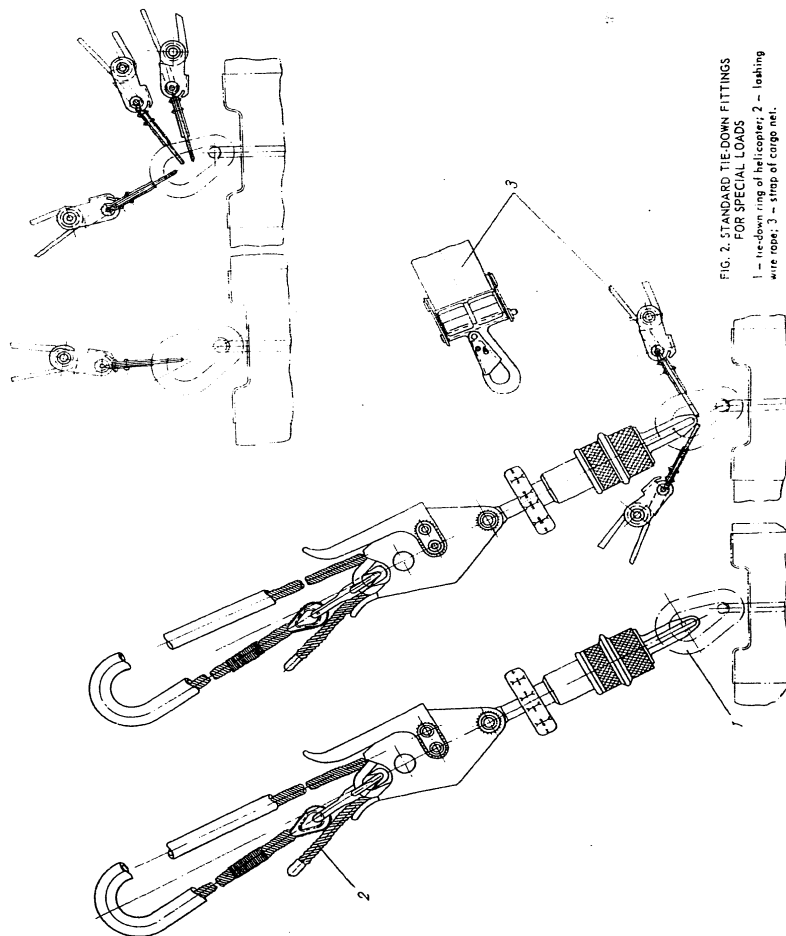


FIG. 2. STANDARD TIE-DOWN FITTINGS
FOR SPECIAL LOADS
1 - tie-down ring of helicopter; 2 - loading
wire rope; 3 - strap of cargo net.

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- the middle broken line is plotted along the symmetry axis of the helicopter;
- the side solid lines are painted symmetrically relative to the helicopter fore-and-aft axis over the stressed beams of the floor.

The stressed portion of the floor is hatched with white lines.

Fitted on the cargo compartment floor and the ramps are tie-down fittings (rings). Secured to each tie-down ring at a time can be one lashing wire rope and two straps of the cargo net; it is forbidden to attach two lashing ropes to one ring simultaneously (Fig.2).

Provided at the rear end of the cargo compartment at frame No.26 of the fuselage are cargo loading doors and loading ramps (approximately 3500 mm long).

The port side of the fuselage (between frames Nos 8 - 10 and 22 - 24) and the starboard side (between frames Nos 22 - 24) have doors whose dimensions are as follows:

- (a) forward door 1705 x 805 mm;
- (b) backward doors 1740 x 805 mm.

Loads are lifted into the helicopter with the aid of the MHP-3 electrically-operated winch installed on the front portion of the cargo compartment floor.

The winch is supplied with 27 volts D.C. from the ground power supply source; in addition, the winch is provided with a hand drive.

The maximum allowable pulling power of the winch is 800 kg; the pulling wire rope of the winch is 50 m long and measures 5 mm in diameter.

To prevent wire rope breakage in load hoisting, the winch is fitted with a friction clutch which ensures slipping of the winch drum in case the load exceeds the rated value of 800 kg.

The rigging set of the helicopter includes a pulley block which augments the pulling power of the winch to 4000 kg.

The MHP-3 winch has two wire rope speeds:

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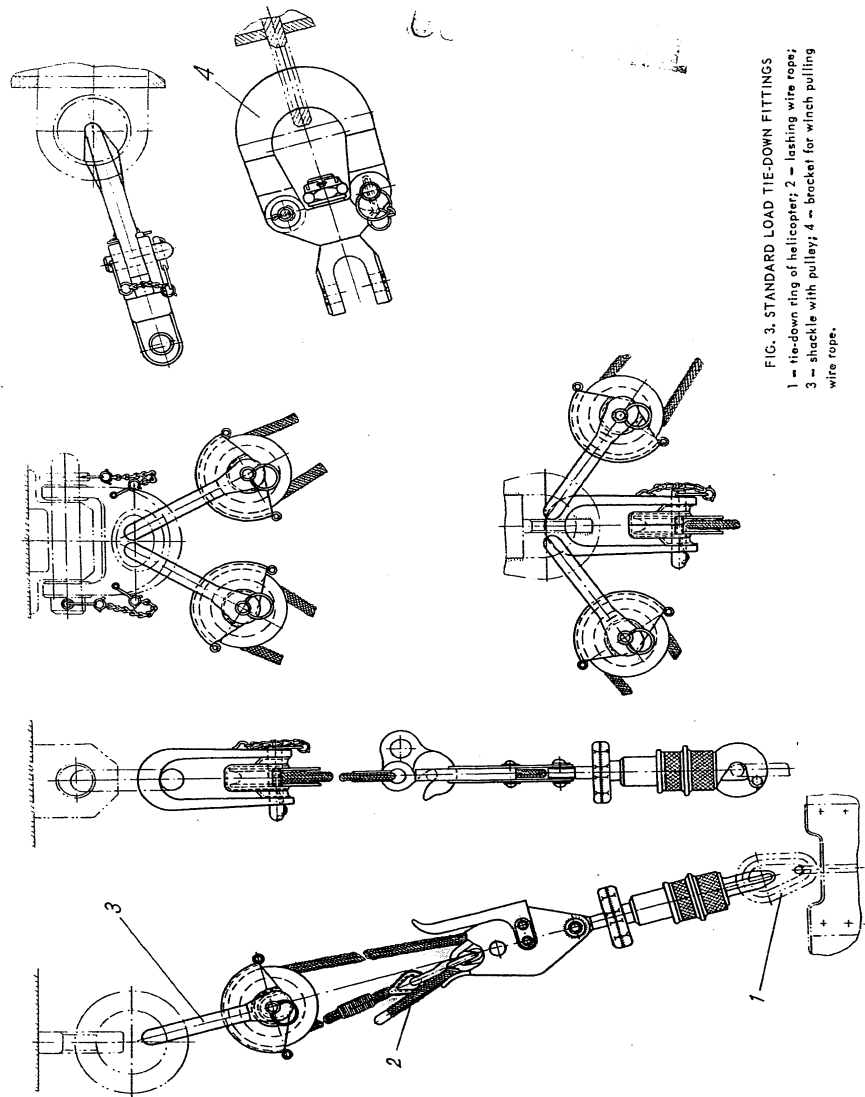


FIG. 3. STANDARD LOAD TIE-DOWN FITTINGS
1 - tie-down ring of helicopter; 2 - lashing wire rope;
3 - shackle with pulley; 4 - bracket for winch pulling
wire rope.

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Wire rope speed	One motor operating	Two motors operating
Pay-out speed	0.6 m/sec	1.2 m/sec
Heave-in speed	0.2 m/sec	0.5 m/sec

The winch is controlled with the aid of a portable control box, type ПВН-1А.

3. TECHNICAL REQUIREMENTS FOR LOADS SHIPPED IN HELICOPTER CARGO COMPARTMENT

1. All loads of over 100 kg to be loaded in the helicopter should be either fitted with wheels or mounted on special trolleys which offer convenience in loading operations.

2. Trolley-carried loads should be reliably secured on the trolleys.

3. Small-size loads should be well packed.

4. Tie-down fittings on shipped loads should ensure convenient and reliable fastening of their mating tie-down devices (links with rollers or lashing wire ropes).

Fig. 3 pictures standard tie-down fittings which are recommended for load shipment on helicopters.

C.G. positions should be marked on loads to be shipped.

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Section II

CARGO LOADING, LOCATING, LASHING, ATTENDING AND UNLOADING TECHNIQUES

1. DUTIES OF LOADING TEAM

Cargoes and technical equipment are loaded, unloaded and lashed down in the helicopter by a briefed team of four or six (depending on the size and weight of loads) under the supervision of the helicopter technician.

In loading, the stations of the crew members should normally be as follows:

- (a) one or two men supervise loading operations;
- (b) two men prevent back rolling of loads, checking them with chocks;
- (c) one or two men control the wheels of the driven-in equipment (or trolley-mounted cargo).

The loading winch is operated by the helicopter technician.

2. LOADING OF TECHNICAL EQUIPMENT

AND TROLLEY-MOUNTED LOADS

Items of technical equipment and packed loads are loaded into the helicopter body through the cargo hatch door, with the use of the ramps. Small-size loads may be also brought in through the doors of the cargo compartment.

For loading operations, assemble the pulley block into a system specified for the weight of the given load (See the diagram illustrating the pulley block reeving used inside the helicopter cargo compartment, Fig.4).

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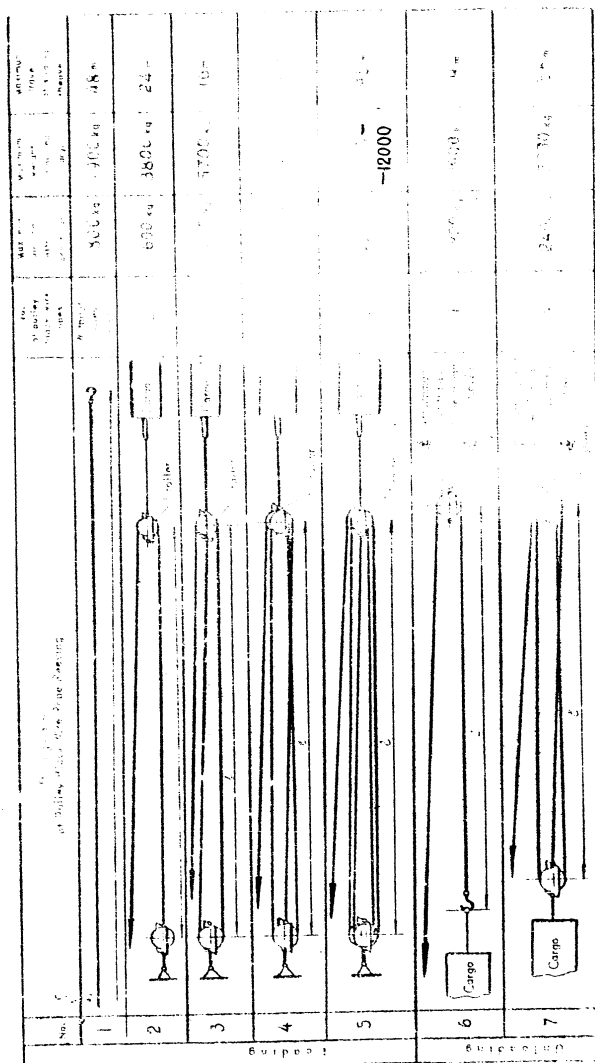


FIG. 4. DIAGRAM OF PULLEY BLOCK A-1 ROPE REEVING

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The column "Maximum weight of heaved-in load" presents the weights of wheel-mounted technical equipment; the weights of wheels proper (or wheeled trolleys) are included in the weights indicated in the column.

Boxed loads and wheeled technical equipment items are attached to the movable block of the pulley block assembly by means of fixtures contained in the pulley block assembly set.

The method of attachment to the pulling block of the pulley block assembly or to the end of the winch wire rope (when the pulley block assembly is not used) depends on the type of the equipment being loaded and on the possibility of attaching the loading devices to it.

If the winch fails to drive the load to the stowing position in the helicopter cargo compartment, the load should be arranged in the allotted place by the loading team manually.

Prior to loading, the technical equipment should be brought as close as possible to the ramps and arranged along the symmetry axis of the helicopter.

When loading vehicles, check their movement with chocks. When two vehicles coupled together are driven in, place chocks under the wheels of the forward vehicle.

A special flooring should be placed on the cargo compartment floor before loading tracked vehicles into the helicopter.

Prior to loading three-axle vehicles set up the middle and end ramps (Fig.5). The main starboard ramp has two holes which receive the stud pins of the middle ramp. The end ramp is attached to the middle one by means of hooks.

Observe the following requirements in loading:

- (a) the pulling wire rope should be attached to the load in a symmetrical manner;
- (b) the gaps between the helicopter side walls and the loads in the compartment should be roughly equal;
- (c) the movable block of the pulley block assembly should not touch the fixed block.

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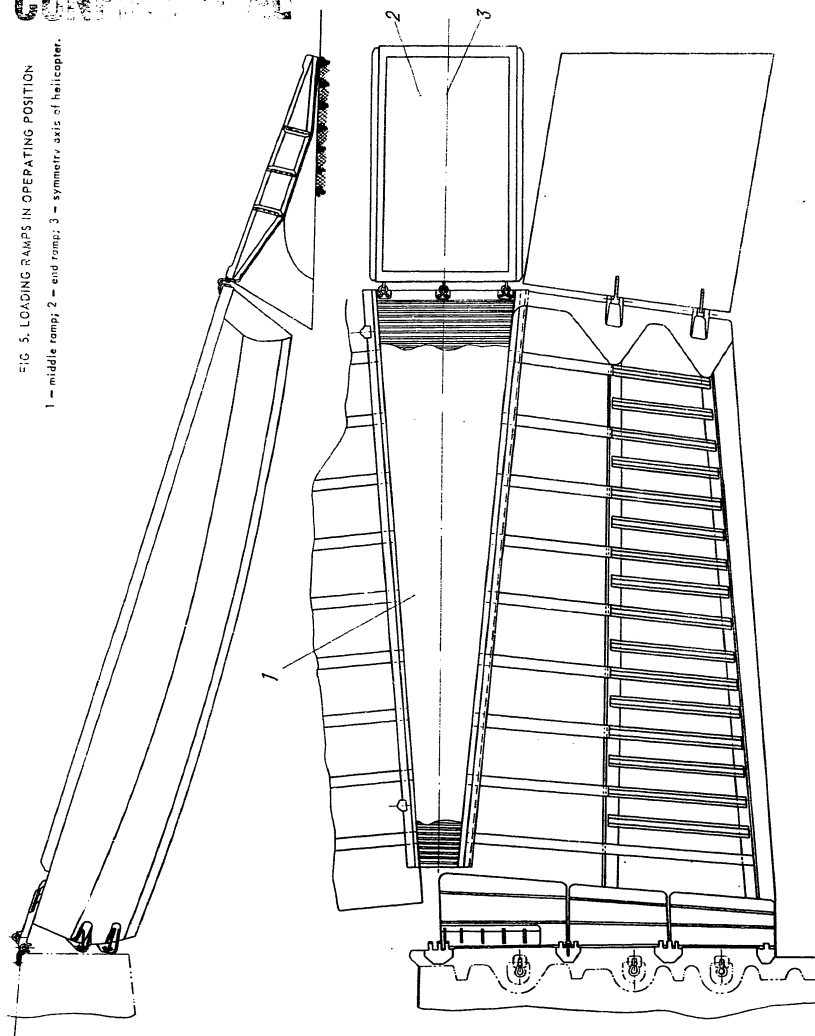
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FIG. 3. LOADING RAMPS IN OPERATING POSITION
1 - middle ramp; 2 - end ramp; 3 - symmetry axis of helicopter.



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3. ARRANGEMENT OF LOADS AND STATIONS OF ATTENDING PERSONNEL

The arrangement of the loads and stations of the attending personnel should correspond to the marking available on the wall of the cargo compartment (Fig.6).

The C.G. location of the helicopter is determined longitudinally with respect to the main rotor axis.

In case of non-symmetrical loading of the helicopter, the C.G. position should be also determined in the lateral direction; in this event the momentum relative to the helicopter fore-and-aft axis should not exceed 4000 kg-m.

Safe C.G. position limits:

- (a) extreme forward +360 mm (fore of the main rotor axis)
- (b) extreme backward -200 mm (aft of the main rotor axis)

The cargo compartment of the helicopter is capable of carrying up to 12 tons of load (the weight of the handling and tie-down equipment inclusive).

Painted on the starboard side of the fuselage inside the cargo compartment are blue, red and yellow arrows with indications of the load weight in tons.

To keep within the specified C.G. position limits it is advisable to arrange the common centre of gravity of the carried loads (the handling and tie-down equipment inclusive) between the blue and red arrows which correspond to the total weight of the carried loads; should it be otherwise necessitated, the centre of gravity may be also located between the blue and yellow arrows.

The location of the common centre of gravity of all the loads carried in the cargo compartment with respect to frame No.1 shall be determined from the formula:

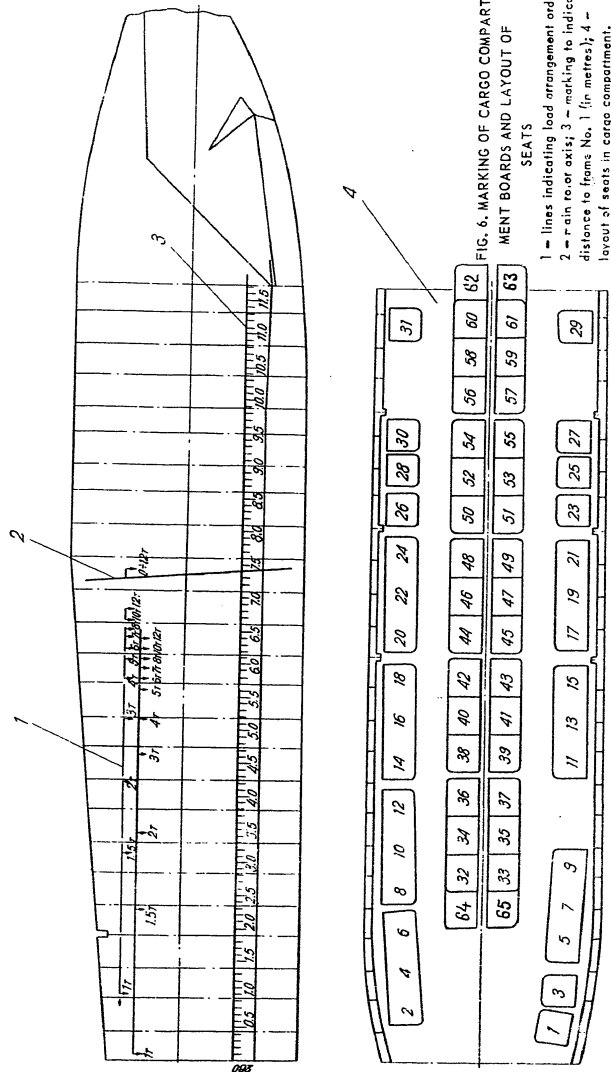
$$X_{c.g.} = \frac{X_1 \cdot G_1 + X_2 \cdot G_2 + \dots + X_n \cdot G_n}{G_1 + G_2 + \dots + G_n},$$

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where: $X_{C.G.}$ - the distance (in metres) between the common centre of gravity of carried loads and frame No.1;
 $X_1, X_2, \dots, X_n$ - distances between centres of gravity of separate loads carried and frame No.1 (in metres);
 $G_1, G_2, \dots, G_n$ - weights of separate loads carried (in tons).

Vehicles should be arranged in the cargo compartment of the helicopter in accordance with the specified distance between the C.G. location of the vehicle and fuselage frame No.1 accurate to ± 50 mm.

The distance to frame No.1 is determined by the marks put in black paint on the starboard side of the cargo compartment.

If the specific load on the floor is in excess of the specified values, special weight distributing chocks should be placed under the wheels, and a special flooring should be arranged under tracked vehicles. Maximum allowable loads on the cargo compartment floor and ramps during loading and in shipment are indicated in the tables presented in Figs 7 and 8.

When in shipping position, secure the vehicle wheels with chocks.

Packed loads should be arranged in the compartment symmetrically with respect to the helicopter fore-and-aft axis and positioned so as to prevent loose movements after tying them down.

4. LASHING-DOWN OF LOADS

Loads are tied down to the helicopter cargo compartment floor by means of lashing wire ropes.

Small-size loads are secured on the cargo compartment floor with the aid of cargo nets.

If carried loads are provided with special tie-down fittings (Fig.3), it is advisable to lash them with the use of a shackle-and-pulley assembly which will safeguard the wire rope against sharp-angle bending.

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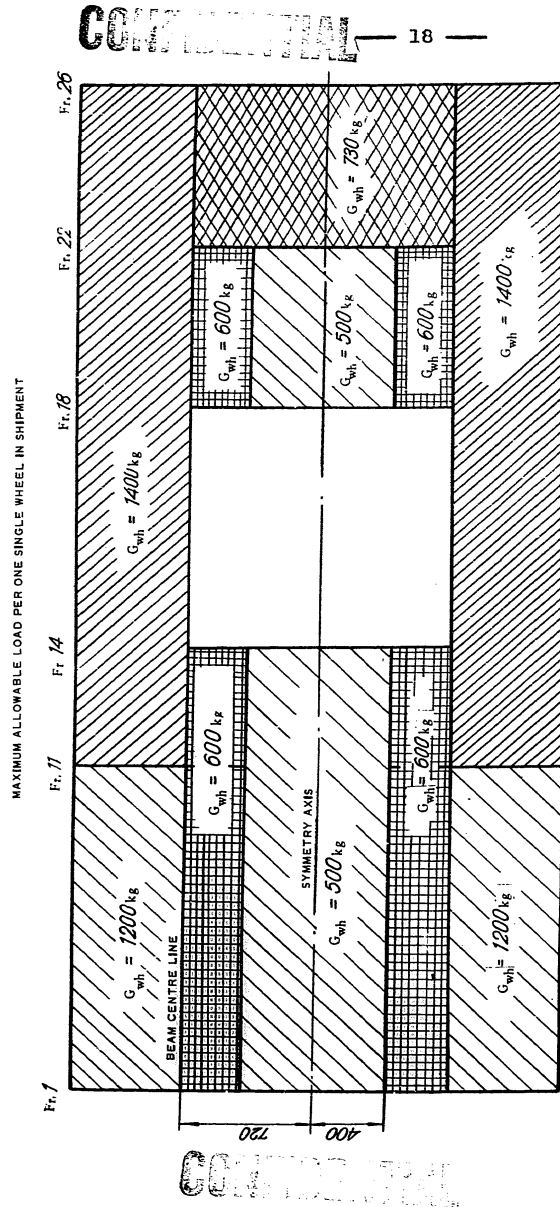
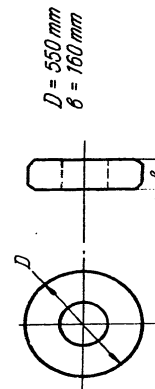


FIG. 7. MAXIMUM LOADING OF CARGO COMPARTMENT FLOOR DURING SHIPMENT OF WHEELED EQUIPMENT

- (a) Inflated tyres of wheels should have the following dimensions (min.):
 $D = 550 \text{ mm}$;
 $b = 160 \text{ mm}$;
- (b) a special flooring is necessary when the equipment is moved on smaller-size inflated wheels or on hard wheels;
- (c) if the loading of the cargo compartment floor is greater than specified in this diagram, load distribution checks or floorings should be laid under the wheels; in this case the maximum allowable loading in the given area: G_{max} per one wheel equals 2000 kg, and per a twin wheel - 3000 kg;

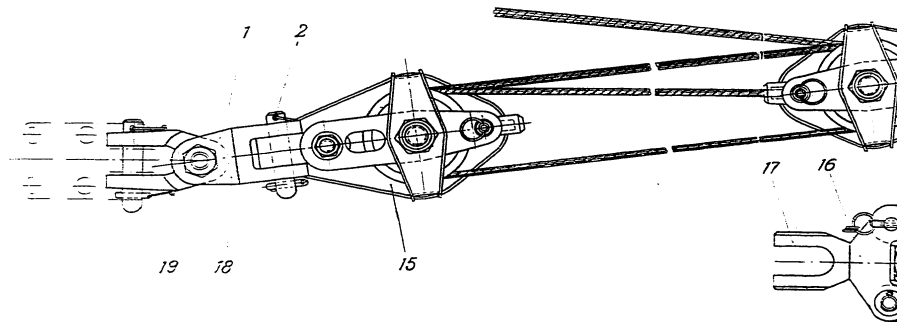
DIMENSIONS OF INFLATED TYRE WHEELS



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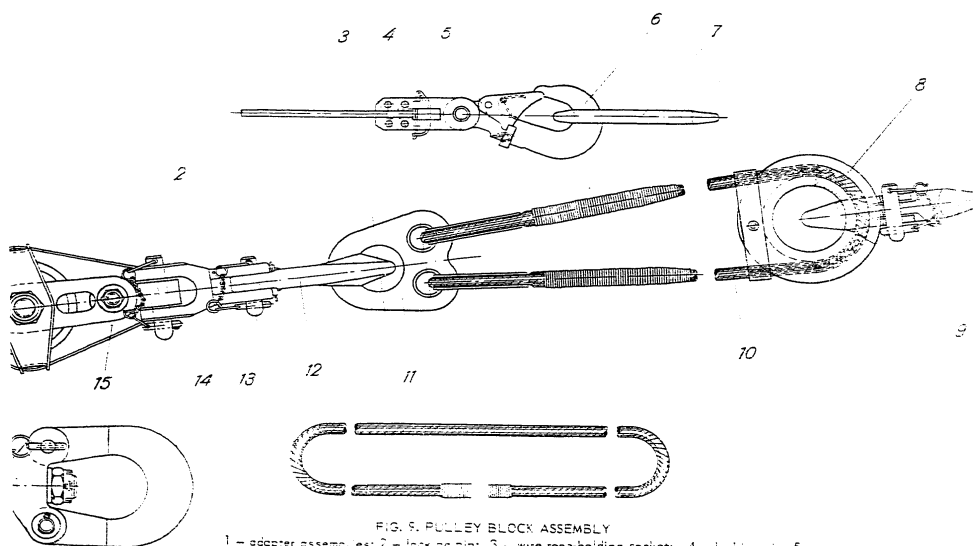
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FIG. 8. PULLEY BLOCK ASSEMBLY

1 - adapter assembly; 2 - locking pin; 3 - wire rope-holding socket; 4 - locking pin; 5 - latch on hook; 6 - hook; 7 - shackle; 8 - ring; 9 - connection link; 10 - end wire rope; 11 - shackle; 12 - splitting ring assembly; 13 - wire rope loop; 14 - bracket; 15 - two-sheave block; 16 - fork; 17 - fork; 18 - adapter; 19 - adapter.

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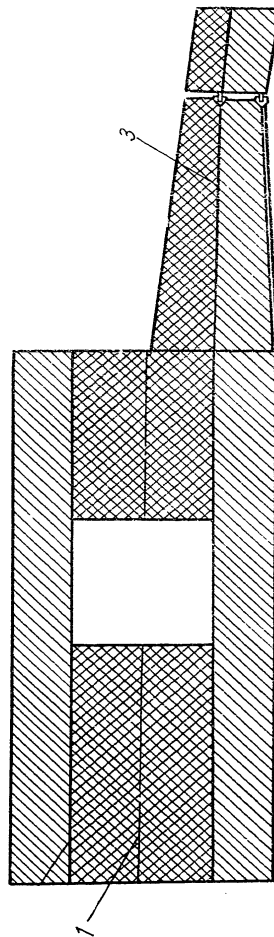


FIG. 8. ALLOWABLE WEIGHT OF TRACKED VEHICLES
FOR SHIPMENT BY HELICOPTER

1 - helicopter symmetry axis; 2 - centre line of stressed

beam of floor assembly; 3 - ramps.

MAXIMUM WEIGHT OF ONE TRACKED VEHICLE - 6000 KG.

ALLOWABLE WEIGHT OF TWO CARRIABLE TRACKED
VEHICLES - NOT IN EXCESS OF 12,000 KG.



MAXIMUM WEIGHT OF ONE TRACKED VEHICLE - 2000 KG.

ALLOWABLE WEIGHT OF TWO CARRIABLE TRACKED
VEHICLES - NOT IN EXCESS OF 4000 KG.



IT IS FORBIDDEN TO CARRY LOADS INSTALLED ON RAMP; THE SAME DIAGRAM APPLIES FOR UNIFORMLY DISTRIBUTED LOADS, TOO.

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Prior to installing a lashing wire rope on the equipment, its turnbuckle should be fully unscrewed.

When lashing down loads, see to it that a rubberized canvas hose is interposed between the lashing wire rope and the equipment it fastens. Wooden blocks should be provided at sharp bends of the wire ropes.

Vehicles and packed loads should be lashed as follows:

- (a) install as many wire ropes as needed;
- (b) pre-tighten the wire ropes with the aid of the wedging fixture;
- (c) tighten the wire ropes by means of turnbuckles.

When lashing the loads with wire ropes, tighten alternately opposing pairs of wire ropes. All wire ropes should be tightened uniformly. Coil up free ends of the ropes.

If loads are being fastened with cargo nets, tighten alternately the opposing pairs of net straps.

Each strap should be tightened with a crew of two: one man tightens the net, while the other pulls the strap through the strap fastener. All the straps should be hand-tightened uniformly. Coil up free ends of cargo net straps.

5. UNLOADING

Packed loads and vehicles should be unloaded in the reverse order of loading.

Light carriable loads shall be unloaded manually.

Vehicles and trolley-mounted loads are driven out from the cargo compartment as a rule manually with obligatory safetying by means of the winch wire rope; in this case the winch pays out the wire rope.

Self-propelled vehicles should drive out of the helicopter at low gear speed.

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S e c t i o n I I I

DESCRIPTION OF HANDLING AND TIE-DOWN EQUIPMENT

The handling and tie-down equipment is intended for loading, lashing and unloading various loads and vehicles. This equipment includes a pulley block assembly, lashing and sectional wire ropes, lashing wire rope rings, shackle-and-pulley assemblies, nets (bigger and smaller), chocks, weight distributing chocks, flooring, jacks and ramps (middle and end).

1. PULLEY BLOCK ASSEMBLY

The pulley block assembly (Fig.9) is intended to increase the pulling power of the MHF-3 winch when loading heavy loads into the helicopter cargo compartment. The assembly includes blocks, adapter assemblies, a hook complete with shackle, wire ropes and a loop.

Single-pulley and two-pulley blocks are available (See Figs 10 and 11) in the pulley block assembly. Pulleys 2 are supported on bolt 1 between the cheeks. To prevent slipping of the winch wire rope from the pulleys during the operation, special safety clips 4 are installed on the pulley blocks. Bottom plate 3 protects the assembly from damage when the block is slid on the floor of the cargo compartment. Each pulley block has two coupling assemblies to attach the pulling fixture of the pulley block assembly and the end of the winch wire rope. One coupling assembly is shackle 5 with an eye to receive the locking pin; the shackle is mounted on bolt 6 between the cheeks of the block. The second coupling assembly

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consists of spacing socket 7 which rocks between the cheeks serving as bearings for the socket. The side of the spacing socket has a teat with a slot for fitting the end of the winch wire rope. Lock 8 provided in the socket prevents falling out of the wire rope.

Adapter assemblies 1 (Fig.9) consist of two adapters 18 and 19 shaped as forks. The adapters are coupled together by means of a bolt.

The fixtures intended for coupling the pulling end of the winch wire rope or the movable block of the pulley block assembly (through which the load is attached) are: the hook-and-shackle assembly, split ring assembly, end wire rope, wire rope loop and unloading wire rope.

Hook 6 with shackle 7 (Fig.9) is attached to the end of the winch wire rope and is intended for hooking vehicles and packed loads when these are loaded in the helicopter cargo compartment without use of the pulley block assembly. The pulling power of the winch in this case should not exceed 800 kg. The hook is of a snap type; hook latch 5 protects the load from inadvertent uncoupling. Hinged to the hook is wire rope holding socket 3 with pin 4 which retains the wire rope in the socket.

The ends of end wire rope assembly 10 (Fig.9) are thimble-spliced in the eyes of shackle 11. The shackle is jointed to the movable block by means of split ring assembly 12. The wire rope is fitted over a ring secured in which is a connecting link consisting of two clamps fastened by means of locking pins. The end wire rope assembly is used to attach the load if the pulley block assembly fails to reach it.

The split ring assembly (Fig.9) is used for coupling the load being pulled into the cargo compartment. The assembly consists of bracket 14 connected to the forks by means of locking pins. Fork 17 is attached to the shackle of the movable block of the pulley block assembly. Forks 16 and 17 form a swivel which allows the blocks of the pulley block assembly to keep the horizontal position irrespective of the position of the fastening ropes on the loads being loaded.

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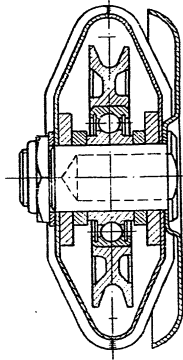
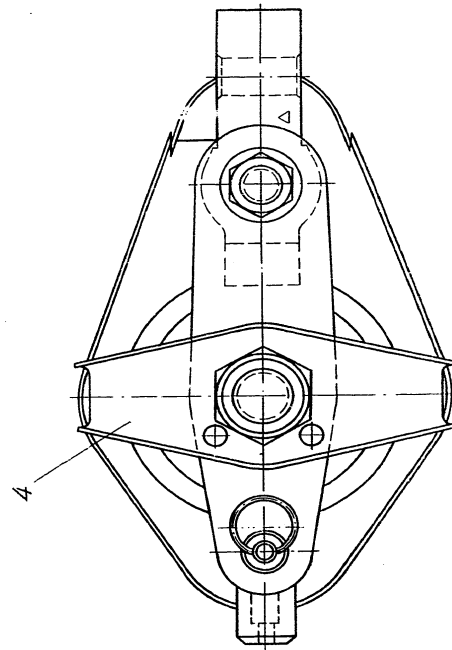
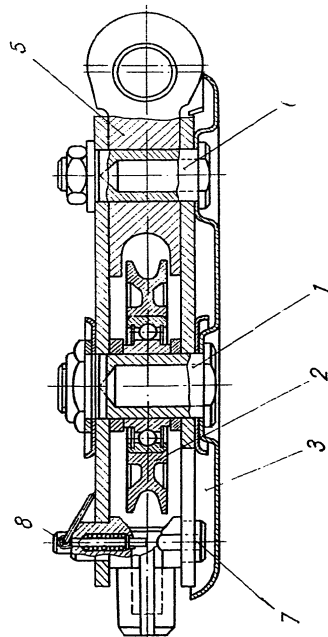


FIG. 10. SINGLE-PULLEY BLOCK
 1 - cheek attachment bolt; 2 - pulley; 3 - bottom
 plate; 4 - safety clip; 5 - shackle with eyes; 6 -
 shackle attachment bolt; 7 - spacing socket;
 8 - lock.



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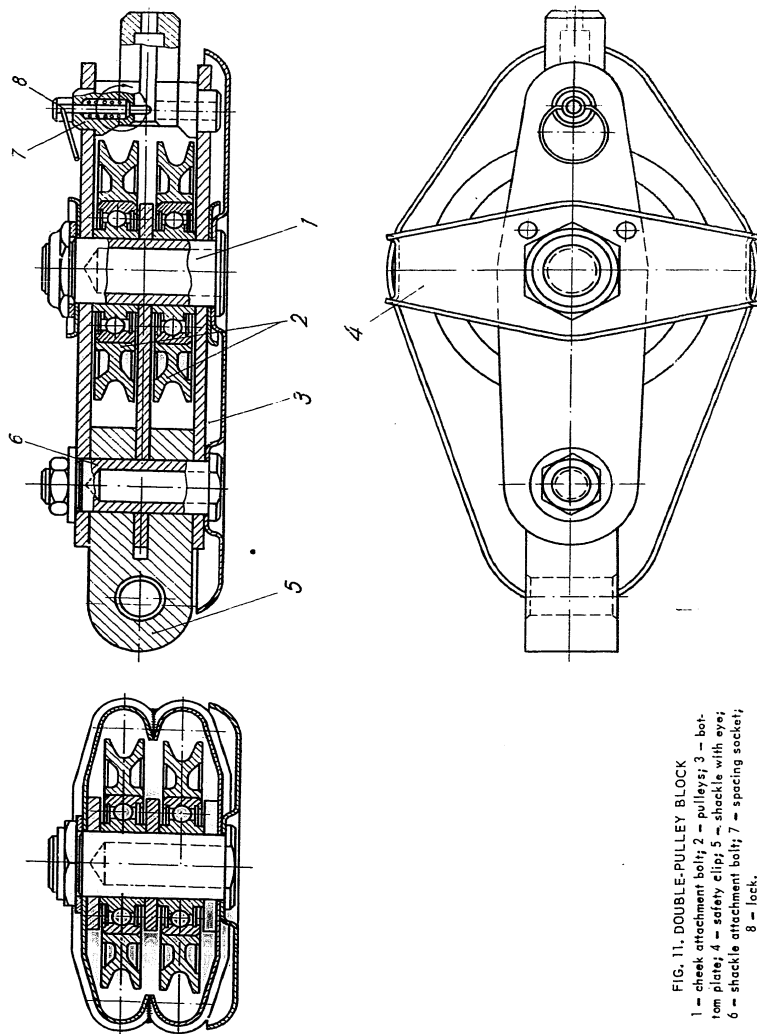


FIG. 11. DOUBLE-PULLEY BLOCK
 1 - cheek attachment bolt; 2 - pulleys; 3 - bottom plate; 4 - safety clip; 5 - shackle with eye; 6 - shackle attachment bolt; 7 - spacing socket; 8 - lock.

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Wire rope loop 13 (Fig.9) is employed for load attachment in cases when the load fails to be attached by all the other coupling fixtures available; the loop is a piece of wire rope whose ends are spliced together.

The complement of coupling fixtures contains two wire rope loops: one loop is made of 9.5-mm dia. wire rope and is 1 m long; the other uses 11.5-mm dia. wire rope and is 2.75 m long.

The pulley block assembly (Fig.9) is assembled and fitted as follows:

(a) attach adapter 19 of assembly 1 to the bracket at the winch on the cargo compartment floor. Attach the block (either single-pulley or two-pulley) to second adapter 18 of this assembly. All the subassemblies of the pulley block assembly are jointed together similarly: by means of locking pins 2 attached to their respective parts by means of chains. Next install the second block of the pulley block assembly and fit the winch wire rope through the assembly; while doing this, check the pulleys of the blocks for free rotation. The method of fitting the winch wire rope through the pulley block is selected depending upon the pulling power required;

(b) connect the LVII-1A winch control box and check the winch and pulley block assembly for operation.

The requirements to be met when attaching the pulling block of the pulley block assembly to the load are as follows:

(a) if one hook or coupling fixture installed on the load along the symmetry axis is used, the load is attached by means of:

- the split ring if the movable block of the pulley block assembly reaches the load;
- the end wire rope assembly if the movable block fails to reach the load;

(b) if two hooks arranged symmetrically on the load are used, the attachment is accomplished by means of the end wire rope (without making use of rings).

In all cases of attaching the pulley block assembly or the pulling wire rope hook (without the pulley block assembly)

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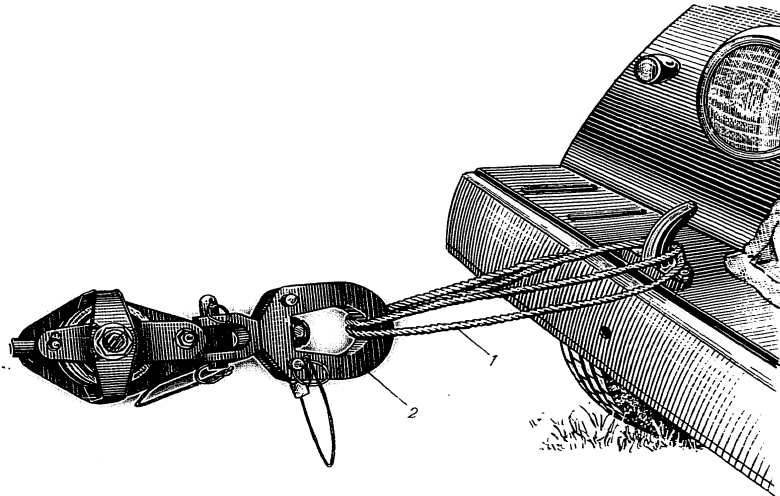


FIG. 12. ATTACHMENT OF PULLEY BLOCK TO TRUCK
BY MEANS OF SPLIT RING AND WIRE ROPE LOOP
1 - wire rope loop; 2 - split ring

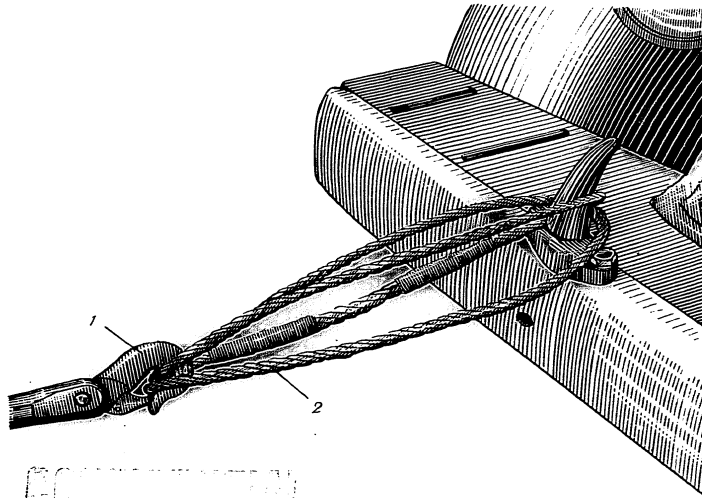
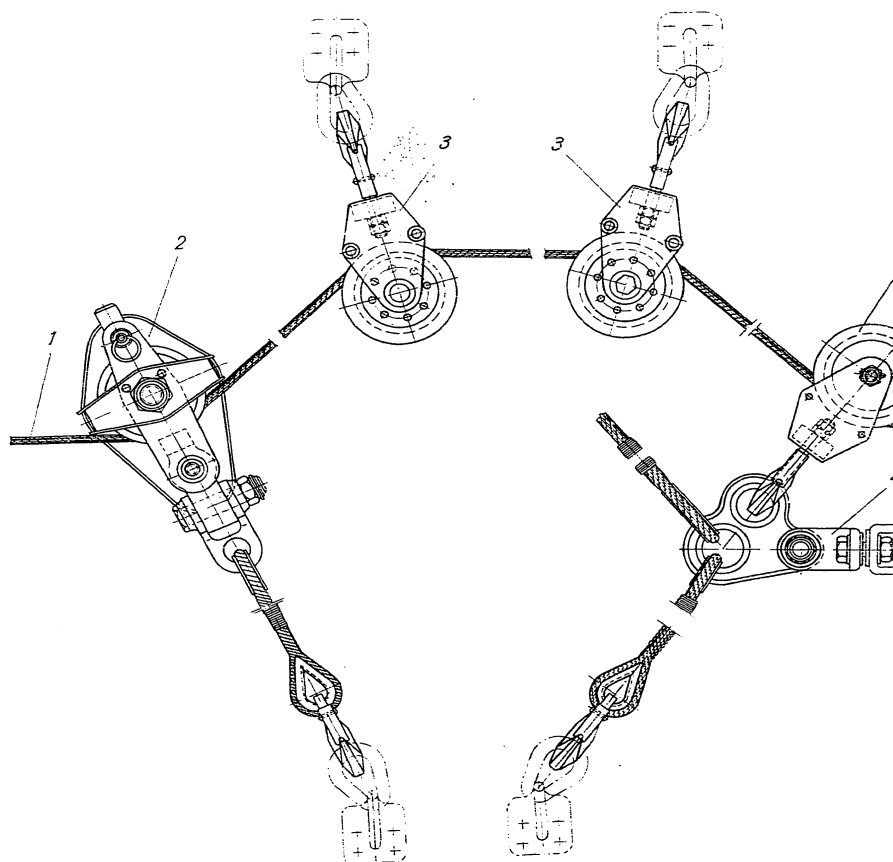


FIG. 13. ATTACHMENT OF WINCH WIRE ROPE TO TRUCK
BY MEANS OF WIRE ROPE LOOP
1 - hook; 2 - wire rope loop

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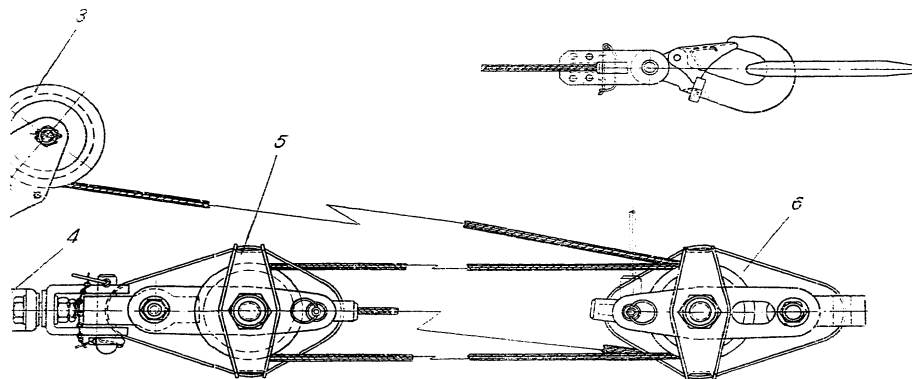


FIG. 18. ASSEMBLIES OF PULLEY BLOCK GO-AROUND SYSTEM
1 - winch wire rope; 2 - wire rope with single pulley block; 3 - corner blocks; 4 - pulley block attachment fitting; 5 - fixed block; 6 - movable block.

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to the load use may be made of the wire rope loops (Figs 12 and 13).

2. GO-AROUND SYSTEM OF PULLEY BLOCK

The pulley block go-around system is intended for pulling-in operations of the helicopter winch JHP-3 when the front section of the cargo compartment is already loaded and the winch wire rope cannot be passed along the centre line of the compartment.

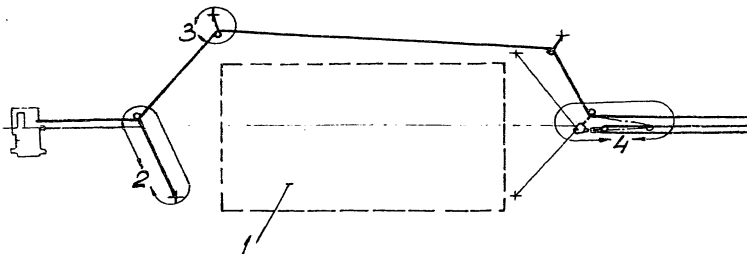


FIG. 14. GENERAL LAYOUT OF PULLEY BLOCK GO-AROUND SYSTEM

1 - load; 2 - wire rope with single-pulley block; 3 - corner block;
4 - pulley block attachment fitting.

Fig.14 pictures general layout of the pulley block assembly go-around system. The go-around system comprises the following assemblies (Fig.15):

- (a) wire rope with single-pulley block 2;
- (b) corner blocks 3;
- (c) pulley block attachment fitting 4.

Corner blocks 3 shift the winch wire rope toward the edge or toward the centre of the helicopter cargo compartment and keep the wire rope in the shifted position during the load pull-in operations.

The corner block consists of welded cheeks, a pulley rotating about an axle bolt and a hook with a snap. A swivel

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is provided in the corner block assembly to ensure self-alignment of the block independently of the hook.

Pulley block attachment fitting 4 consists of a shackle with three holes. Thimble-spliced in one of the holes are two guyed wire ropes which terminate in hooks; these hooks attach the wire ropes to the tie-down rings on the fuselage floor. Attached to the second eye of the shackle is the hook of the last corner block, and to the third eye, the swivel fork of fixed block 5 of the pulley block assembly.

The go-around system ends in the attachment fitting connected to which are the units of the ordinary pulley block assembly.

3. LASHING WIRE ROPES

The lashing wire rope is used for fastening the carried load on the floor of the cargo compartment (Fig.16). The lashing wire rope assembly consists of a steel cable, dia 8 mm, with a hook at its one end, of a wedge clamp and locking hook assembly. The wire ropes are available in three lengths: 3.5 m, 4.5 m and 6.5 m.

The wedge clamp assembly (Fig.17) ensures length adjustment of the wire rope. It consists of body 3, insert 4, and lever 1. The body is built up of cheeks with two welded liners 2 provided with radial grooves. Die-forged insert 4 fitted in the body is also grooved radially. Lever 1 mounted on a pin can move the insert along the axis of the clamp assembly. When a load is being lashed down, the wire rope runs over the radial grooves of the insert and wedge clamp body and becomes clamped when pulled. To release the wire rope and make it possible to freely adjust it in the clamp it is necessary to press the lever to move insert 4 to the forward position, and to keep the insert in this position all the time the wire rope is being passed through. The clamp body is hinged to the eye of the locking hook assembly.

The locking hook assembly (Fig.18) consists of hook 4, lock 3, bush 5, sleeve 2, spring 6, bush 7, handle 1, and eye 8. Hook 4 is screwed into bush 5 and is locked in it with a through-going pin.

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The end of the lock is held in the closed position by means of the sleeve with a spring. To open the lock it is necessary to override the resistance of the spring and to force the sleeve backward. As a result, the lock will turn about its axle pin to open the hook mouth.

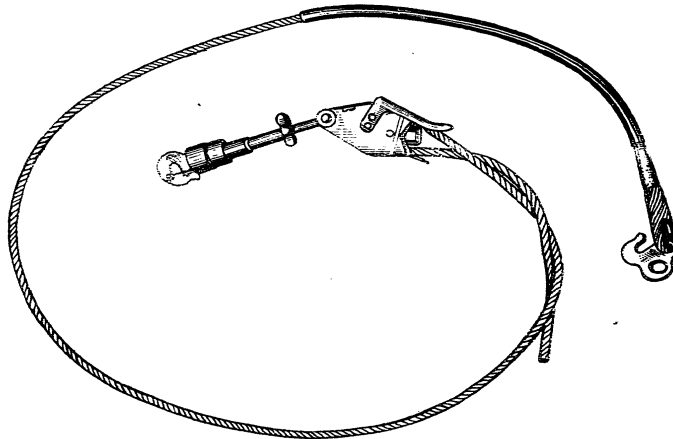


FIG. 16. LASHING WIRE ROPE

Screwed into R.H. threaded bush 7 is a handle provided with external L.H. thread which receives the eye. The eye, the handle, and the bush serve together as a rigging screw which ensures adjustment of the wire rope tension. The total travel length of the rigging screw is 100 mm.

For lashing down the carried load the locking hook of the wire rope is attached to the tie-down ring on the floor of the cargo compartment, the wire rope is passed over the element of the load to be lashed down, the wire rope end with the die-forged hook spliced into it, is attached to the eye of the wedge clamp, and the rigging screw is operated to tighten the wire rope.

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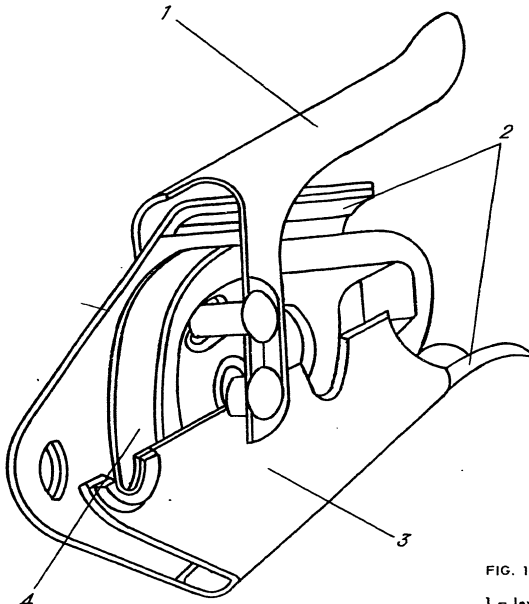


FIG. 17. WEDGE CLAMP OF WIRE ROPE
1 - lever; 2 - liner; 3 - body;
4 - insert.

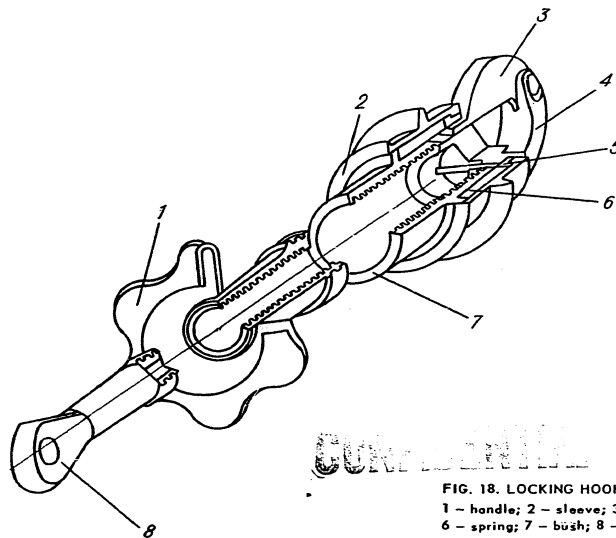


FIG. 18. LOCKING HOOK ASSEMBLY
1 - handle; 2 - sleeve; 3 - lock; 4 - hook; 5 - bush;
6 - spring; 7 - bush; 8 - eye.

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4. WIRE ROPE RINGS

The wire rope rings are pieces of wire rope, dia. 8 mm, 0.96 m, and 1.4 m long, along the perimeter; the ends of the wire rope pieces are spliced together to form rings. The wire rope rings are used to extend the length of the lashing wire rope.

5. SHACKLE-AND-PULLEY ASSEMBLY

The shackle-and-pulley assembly (Fig. 19) is intended to safeguard the lashing wire rope against breakage when the wire rope is attached to the shackles of containers and other loads. The shackle-and-pulley assembly consists of a bent shackle mounted between the ends of which on a quick-release pin is a pulley. The pulley is provided with a groove to guide the wire rope and with a guard which prevents slipping out of the wire rope from the pulley.

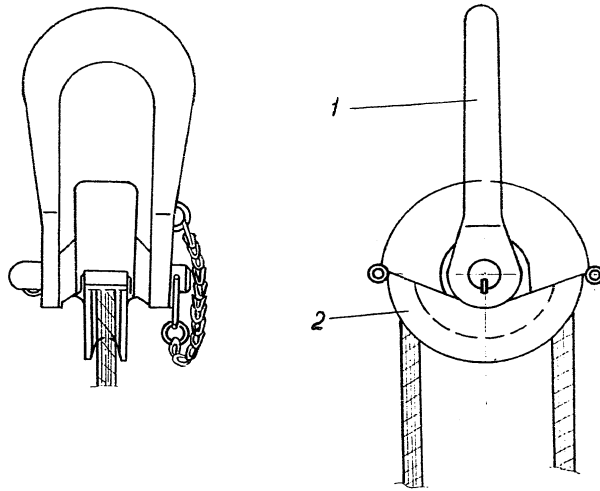


FIG. 19. SHACKLE-AND-PULLEY ASSEMBLY
1 - shackle; 2 - pulley.

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In lashing, the pin is withdrawn, the load shackle is caught by the shackle of the assembly, and the lashing wire rope is fitted into the pulley channel. Next the guard and the pulley are mounted on the pin.

6. CARGO NETS

Two types of cargo nets (Fig.20) are available: the bigger net measures 2500 x 5000 mm, and the smaller net - 1300 x 2200 mm. The nets are used for fastening piece loads to the floor of the cargo compartment. The nets are fabricated of flaxen cord, 10 mm in diameter, and are edged with a flaxen cord, 14 mm in diameter.

Attached along the perimeter of the nets are 30 straps for the bigger net, and 14 straps for the smaller net.

The free ends of the straps are fitted with snap hooks for attaching the net to the tie-down rings on the cargo compartment floor (or to the rings of the sectional wire rope).

The snap hook (Fig.21) ensures that the cargo net strap can be tightened without making knots, and can be quickly released. The snap hook assembly comprises hook 4 with clamp 7 and pawl 3, clip 6, sleeve 1, and net strap 2. The hook with the clamp, rotating about pin 5, becomes pressed with the spring to the sleeve which can freely rotate about hollow shaft 8. The free end of the strap attached to the net passes between the hook clamp and the sleeve. The strap can be freely moved in the assembly in one direction; in the other direction the strap becomes seized between the sleeve and clamp, which is knurled. To release the loads it is required to bring the clamp away from the sleeve and to ease off the strap; then the hook will be freely detached from the tie-down ring.

7. SECTIONAL WIRE ROPES

The sectional wire ropes (Fig.22) are available in two types: longer wire ropes, 2600 mm long, and shorter wire ropes of 1600 mm in length.

These wire ropes are intended for fastening the straps of the cargo net. They consist of sections (8 mm in diameter)

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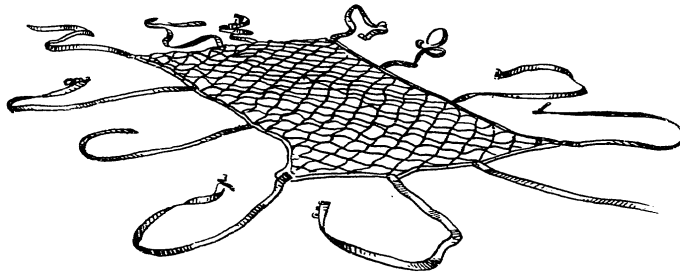


FIG. 20. CARGO NET

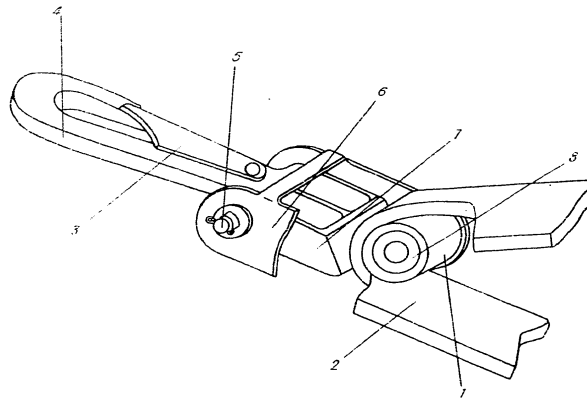


FIG. 21. SNAP HOOK ASSEMBLY
1 - sleeve, 2 - net strap, 3 - pawl, 4 - hook, 5
pin, 6 - clip, 7 - clamp, 8 - shaft.

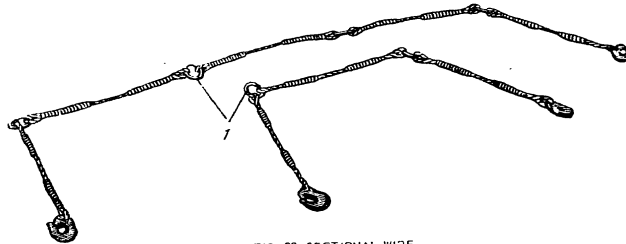


FIG. 22. SECTIONAL WIRE
ROPES
1 - jointing rings.

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spliced on thimbles and jointed together by means of steel rings.

Attached to these rings are snap hooks of the cargo net straps.

The terminal ends of the sectional wire rope are thimble-applied on snap hooks by means of which the cable is attached to the tie-down rings on the helicopter cargo compartment floor.

8. CHOCK

The chock (Fig.23) is used to prevent back rolling of vehicles on the ramps, and loose movement of the vehicles in the cargo compartment of the helicopter.

The chock consists of a duralumin sheet heel lined with rubber on the undersurface, and with granulated cork layer at top. Hinged to heel 1 of the chock is D-piece 3 made of a steel tube. The D-piece rests with its arched portion against height-adjustable support 4.

In its lower portion the support is hinged to the chock heel.

The D-piece with its welded transverse sections serves as a support for the wheels; the height of the D-piece is adjusted in situ by means of the screw jack of the support to suit the wheel diameter.

9. WEIGHT DISTRIBUTING CHOCK

The weight distributing chock (Fig.24) is designed to reduce the specific pressure of the wheels of the equipment being carried on the cargo compartment floor. Apart from this, the chocks also serve to fix the wheels. The chock is built up of a duralumin base measuring 850 x 300 mm with stiffening ribs of sheet steel welded to it. Rubber sheets, 3 mm thick, are cemented to the base. One end of the chock is provided with a wheel non-adjustable support made of steel tubes.

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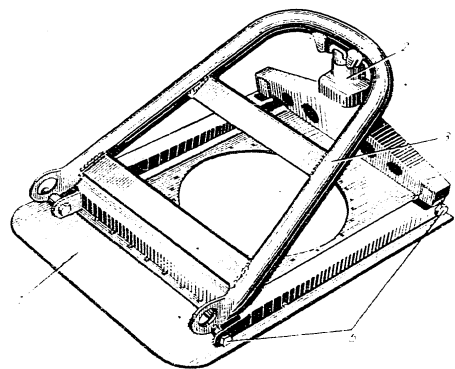


FIG. 23 CHOCK

1. base, 2. adjusting screw of support, 3. support, 4. support, 5. hinge.

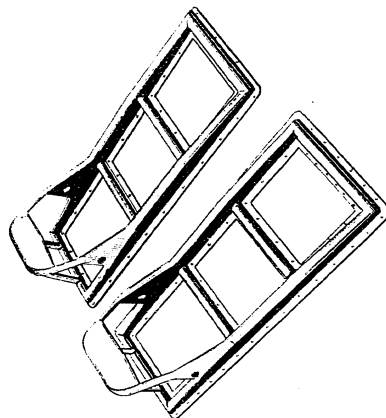


FIG. 24 WEIGHT DISTRIBUTING CHOCK

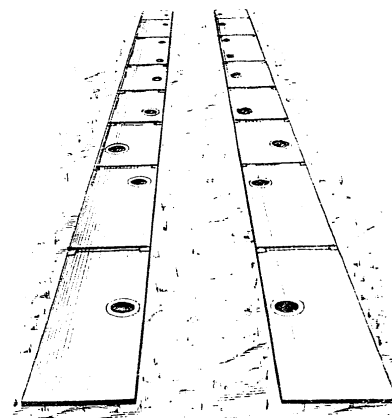


FIG. 25 FLOORING

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10. FLOORING

The flooring (Fig.25) protects the helicopter cargo compartment floor from damage during loading of tracked vehicles.

The flooring set consists of two plywood runways made of separate panels hinged together. The panels are 8 mm thick and 500 mm wide; the length of one runway is 10,080 mm. The butt ends of the panels in the area of hinge joints are edged with sheet steel. At the undersurface the panels are coated with sheet rubber, 2 mm thick, and are lined at top with granulated cork. Provided at one end of each runway is a wire rope with a snap hook for attachment to the tie-down ring on frame No.3 of the cargo compartment floor.

The flooring runways are spaced for the tracks of 1880 mm or 1060 mm (Fig.26). When the 1880-mm track is used (in this case the distance between the inner edges of the runways is 1380 mm) the outer row of the tie-down rings is located outside the flooring, while special openings are provided in the flooring panels for the inner row of the tie-down rings. When the 1060-mm track is used (the distance between the inner edges of the runways in this case equals 550 mm), both rows of the tie-down rings remain fully open.

11. MECHANICAL JACK

Mechanical jacks (Fig.27) are designed for protection of the fuselage from sagging during loading and unloading heavy and large-size loads which may catch the structural members of the helicopter. The jacks are installed under fuselage frame No.22.

The mechanical jacks are shipped together with the load they were used with during loading; in transportation, the jacks are secured to the cargo compartment floor or to the ramps by means of lashing wire ropes. The mechanical jack is built up of vertical tubular pillar 1 supported by three inclined struts 2, and of brace struts 3.

The inclined struts together with the brace struts rest on step bearing 4. For operation (lifting or lowering) the

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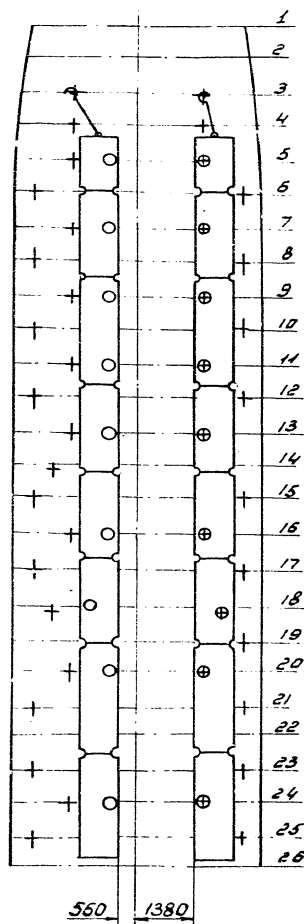


FIG. 26. LAYOUT OF FLOORING IN CARGO COMPARTMENT

+ tie-down rings.

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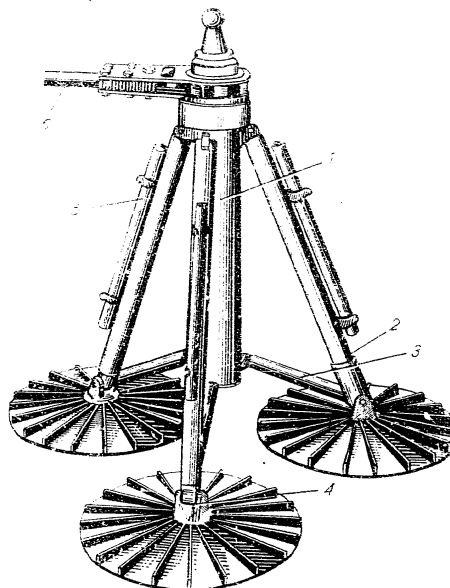


FIG. 27. MECHANICAL JACK
1 - collar; 2 - inclined strut; 3 - main strut; 4 - base bearings;
5 - tube; 6 - detachable lever

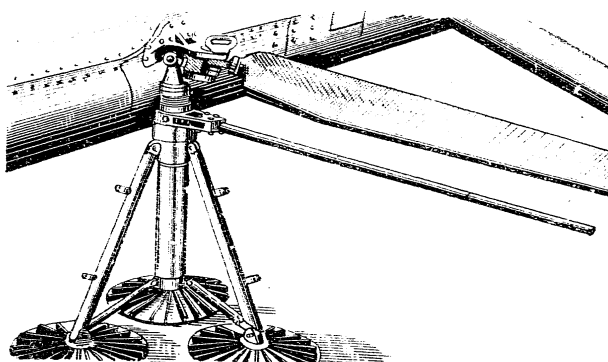


FIG. 28. INSTALLATION OF MECHANICAL JACK

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ratchet mechanism arm is fitted with detachable lever 6 assembled of three tubes 5. When not in use, the levers are removed and secured along the struts of the jack.

The mechanical jack shall be installed as shown in Fig.28.

12. SPRING RELIEVING JACK

The jack (Fig.29) is used to relieve springs of spring-suspended vehicles (automobiles, as a rule) carried in the helicopter cargo compartment.

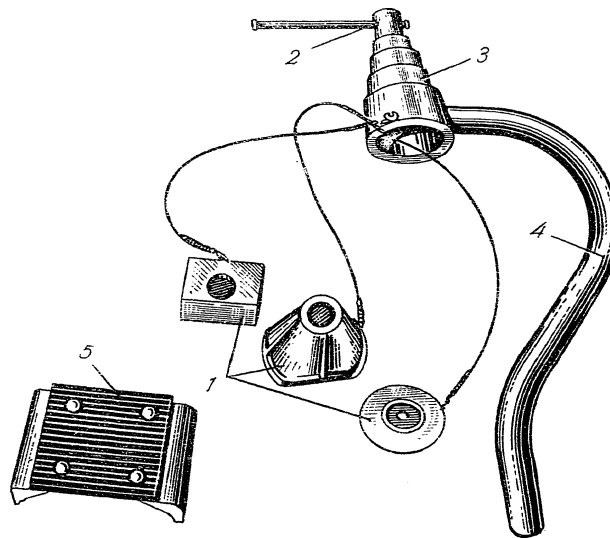


FIG. 29. JACK FOR RELIEVING
AUTOMOBILE SPRINGS

1 - bearings; 2 - handle bar;
3 - threaded bushings; 4 - lever;
5 - support.

The jack consists of four telescopic threaded bushings installed in the centre of which is a shaft with a handle bar.

The operating travel length of the jack is 80 mm.

The top spherical end of the shaft receives bearings of various shapes; the bearings are attached to the outer bushing of the jack by means of flexible wires. Welded to the same

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bushing is a tubular lever. In their upper part the bushings have grooves with a collar which limits the movement of the bushings. Installed in the annular grooves made in the bushings bottoms are spring rings with brass washers which check the downward movement of the bushings. The jack set includes a support with a rubber insert. When necessary, the support is fitted under the jack on the axle of the automobile.

13. LIST OF HANDLING AND TIE-DOWN EQUIPMENT

No.	Description	Dwg No.	Qty	Weight, kg		Note
				1 unit	1 set	
1	2	3	4	5	6	7
1	Pulley block assembly	B9220-900	1 set	30.4	30.4	
	The set includes:					
	(a) two-pulley block		2 pcs			
	(b) single-pulley block		2 pcs			
	(c) adapter assemblies		1 set			
	(d) hook-and-shackle assembly		1 pc.			
	(e) split ring		1 pc.			
	(f) end wire rope assembly		1 pc.			
	(g) wire rope loop		1 pc.			dia 9.5 mm
	(h) wire rope loop		1 pc.			dia. 11.5 mm
	(i) cable for unloading		1 pc.			
2	Go-around system of pulley block assembly	B7903-00	1 assy	16.3	16.3	

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1	2	3	4	5	6	7
	The assembly includes:					
	(a) corner block		4 pcs			
	(b) attachment fitting		1 pc.			
3	Lashing wire rope	B9260-50-5	14 pcs	2.3	32.20	
4	Lashing wire rope	B9260-50-7	16 pcs	2.6	41.60	
5	Lashing wire rope	B9260-50-11	6 pcs	3.2	19.20	
6	Tie-down ring	B9260-120-5	8 pcs	0.305	2.44	
7	Tie-down ring	B9260-120-7	2 pcs	0.435	0.87	
8	Shackle-and-pulley assembly	B7900-750	36 pcs	0.98	35.3	
9	Cargo net, bigger	B7904-00	2 pcs	29.0	58.0	
10	Cargo net, smaller	B7904-20	4 pcs	10.17	40.68	
11	Sectional wire rope	B9260-110-3	2 pcs	1.7	3.40	
12	Sectional wire rope	B9260-110-5	2 pcs	2.6	5.20	
13	Chock	B9220-140	8 pcs	3.3	25.40	
14	Weight distributing chock	B9220-300	4 pcs	3.44	13.76	
15	Flooring assembly	B9922-550	1 set	113.0	113.0	
16	Middle ramp	B0752-10	1 pc.	15.6	15.6	
17	End ramp	B0752-40	1 pc.	12.4	12.4	
18	Mechanical jack	B9930-00	2 pcs	20.0	40.0	
19	Spring-relieving jack	50-9270-00	8 pcs	2.5	20.0	
20	Containers for keeping handling and tie-down equipment	50-9230-50	3 pcs	25.0	75.0	
21	Same	50-9230-100	1 pc.	29.0	29.0	
22	Wheel for loading single-axle vehicles	B7955-100	1 pc.	14.0	14.0	

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All the items of the handling and tie-down equipment are kept in four special containers and are installed on the helicopter only during handling operations and in shipment in the complement necessary for loading, lashing down and unloading of the load carried. During shipment of loads the special containers used for keeping handling and tie-down equipment are not carried on the helicopter.

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S e c t i o n I V

LOAD ARRANGEMENT AND FASTENING VERSIONS(EXAMPLES)

V E R S I O N 1

Arrangement and Fastening of YA3-451 Automobiles

The YA3-451 automobiles shall be pulled into the cargo compartment of the helicopter by means of the helicopter-mounted winch along with the pulley block assembly fitted as shown in Diagram No.3. The automobile may be also driven into the cargo compartment by their own propulsion, with the use of the lowest speed gear. During loading and lashing operations the wheels of the automobiles should be safetied by means of chocks B9220-140. When in the shipping position, the automobiles should be placed on the hand brakes. The rear springs of the YA3-451 automobiles should be relieved by means of jacks 50-B9270-00.

The drivers should take seats Nos 1 and 3 of the helicopter.

When two YA3-451 automobiles are shipped, the following items of handling and tie-down equipment are used:

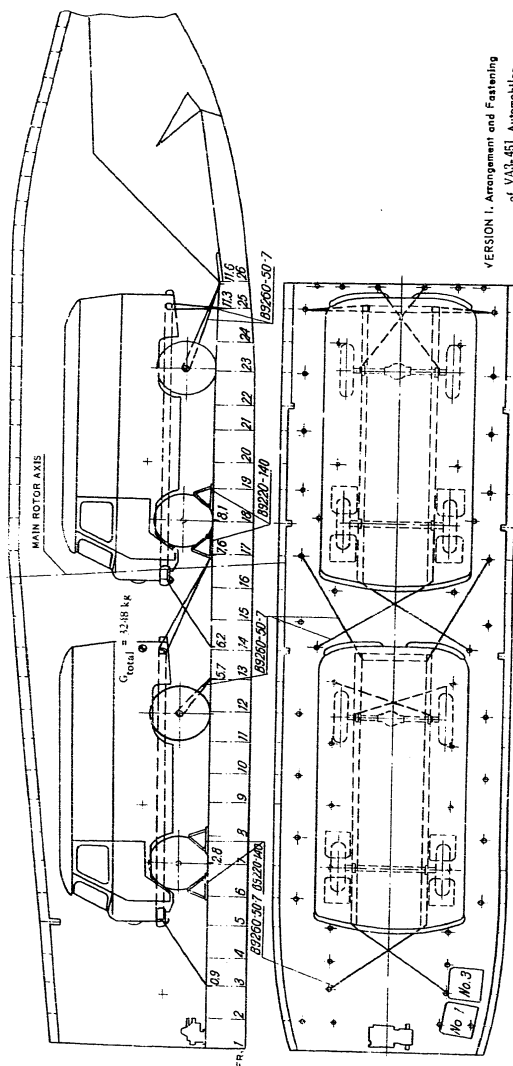
No.	Description	Qty	Weight, kg	
			1 unit	total
1	2	3	4	5
1	Pulley block assembly B9220-900	1 set	30.4	30.4

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VERSION I. Arrangement and Fastening
of YAT-45] Automobiles

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1	2	3	4	5
2	Chock B9220-140	8 pcs	3.3	26.4
3	Wire rope B9260-50-7	12 pcs	2.6	31.2
4	Jack 50-B9270-00	4 pcs	2.5	10

Total weight: 98 kg

The total weight of the loads and rigging equipment amounts to 3248 kg (two YA3-451 automobiles weighing 1500 kg each, two drivers weighing 75 kg each, plus the handling and tie-down equipment weighing 98 kg). In this configuration the centre of gravity of the loads and rigging equipment is located at the distance of 1.205 m from the axis of the helicopter main rotor.

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VERSION 2

Arrangement and Fastening of ЗМЛ-164 Automobile

The automobile, model ЗМЛ-164, should be pulled into the helicopter cargo compartment by means of the helicopter-mounted winch along with the pulley block assembly fitted as shown in Diagram No.4.

In loading and lashing the automobile check its wheels with chocks B9220-140. When in the shipping position, apply the hand brake of the automobile.

The driver should take seat No.1 of the helicopter.

The following handling and tie-down equipment is used for shipping the automobile, model ЗМЛ-164:

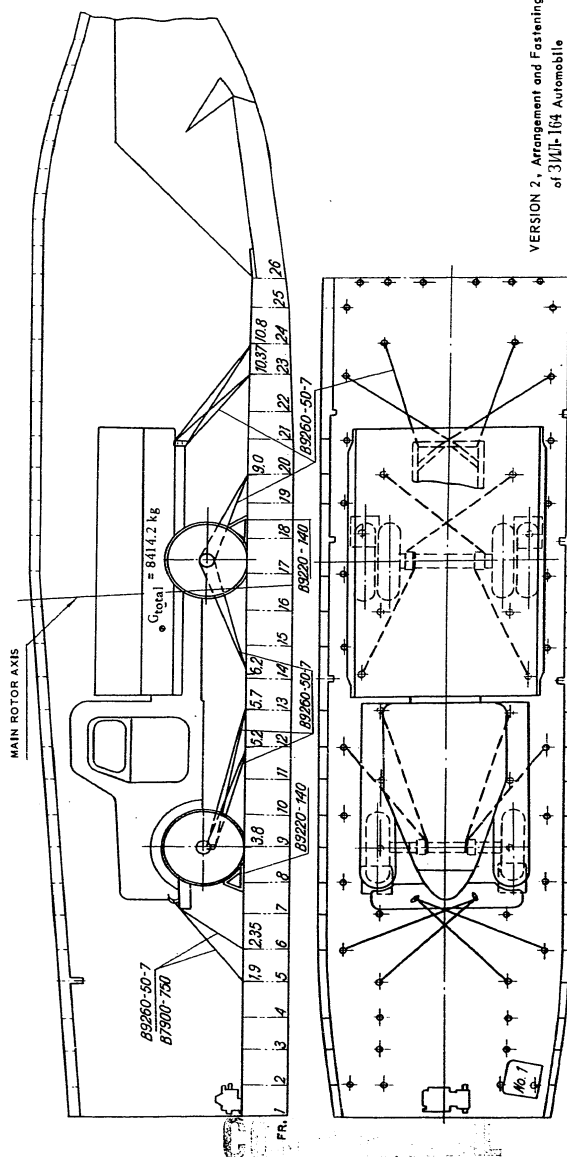
No.	Description	Qty	Weight, kg	
			1 unit	total
1	Pulley block assembly B9220-900	1 set	30.4	30.4
2	Chock B9220-140	4 pcs	3.3	13.2
3	Wire rope B9260-50-7	16 pcs	2.6	41.6
4	Shackle-and-pulley assembly B7900-750	4 pcs	1.0	4.0

Total weight: 89.2 kg

The total weight of the loads and rigging equipment amounts to 8414.2 kg (one ЗМЛ-164 automobile weighing 8250 kg, one driver weighing 75 kg, plus the handling and tie-down equipment weighing 89.2 kg). In this configuration the centre of gravity of the loads and rigging equipment is located at the distance of 0.500 m from the axis of the helicopter main rotor.

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VERSION 2, Arrangement and Fastening of 3M1-164 Automobile

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VERSION 3

Arrangement and Fastening of AT-54 Tractor

The AT-54 tractor should be driven into the helicopter on its own propulsion. Prior to driving the tractor in, place flooring B9922-550 on the floor of the cargo compartment.

The driver should take seat No.1 of the helicopter.

The following handling and tie-down equipment is needed for shipping the AT-54 tractor:

No.	Description	Qty	Weight, kg	
			1 unit	total
1	Wire rope B9260-50-7	10 pcs	2.6	26
2	Shackle-and-pulley assembly B7900-750	2 pcs	1.0	2.0
3	Flooring assembly B9922-550	1 set	113.0	113.0

Total weight: 141 kg

The total weight of the loads and rigging equipment amounts to 5416 kg (one tractor weighing 5200 kg, one driver weighing 75 kg, plus the handling and tie-down equipment weighing 141 kg).

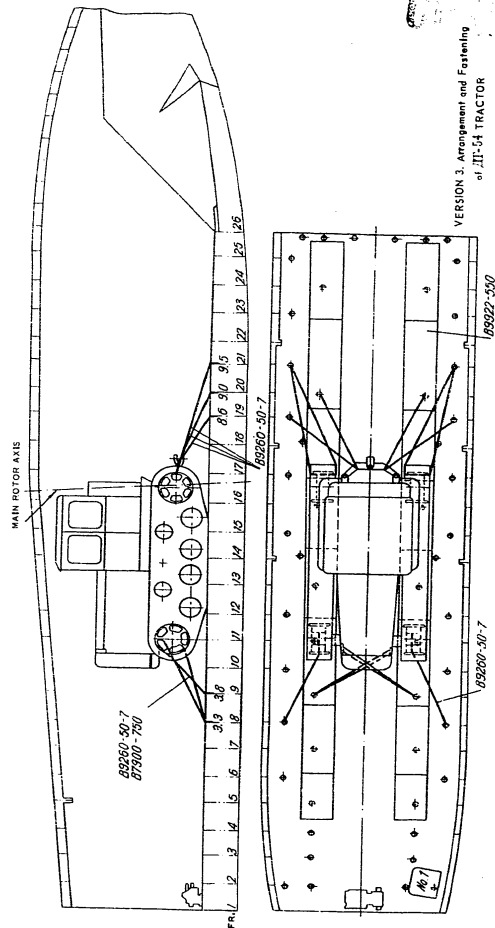
In this configuration the centre of gravity of the loads and rigging equipment is located at the distance of 1.390 m from the axis of the helicopter main rotor.

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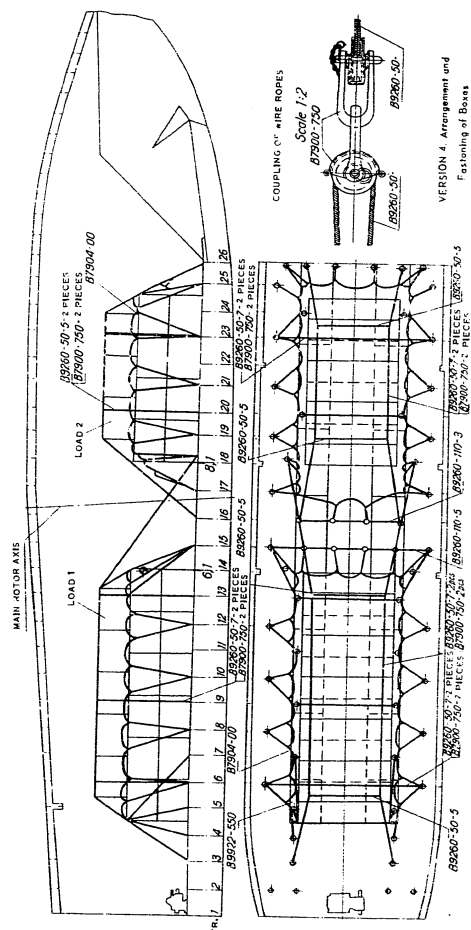
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VERSION 3. Arrangement and Fastening of II-54 TRACTOR

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VERSION 4

Arrangement and Fastening of Boxed Loads

Boxed loads are fastened in the cargo compartment by means of cargo nets and wire ropes.

The wire ropes are linked together through two shackle-and-pulley assemblies B7900-750.

The following handling and tie-down equipment items are used for loading and lashing boxed loads:

No.	Description	Qty	Weight, kg	
			1 unit	total
1	Bigger net B7904-00	2 pcs	29	58
2	Wire rope B9260-50-5	6 pcs	2.3	13.8
3	Wire rope B9260-50-7	16 pcs	2.6	41.6
4	Shackle-and-pulley assembly B7900-750	18 pcs	1	18
5	Sectional wire rope B9260-110-3	1 pc.	1.7	1.7
6	Sectional wire rope B9260-110-5	1 pc.	2.6	2.6
7	Flooring B9922-550	1 set	113	113

Total weight: 248.9 kg

The total weight of the loads and rigging equipment amounts to 5849 kg (load 1 including 34 boxes weighing 100 kg each, load 2 including 22 boxes weighing 100 kg each, plus the handling and tie-down equipment weighing 248.9 kg). In this configuration the centre of gravity of the loads and rigging equipment is located at the distance of 1.189 m from the axis of the helicopter main rotor.

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HELICOPTER ARMAMENT

DESCRIPTION AND OPERATING
INSTRUCTIONS

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INTRODUCTION

The present book contains the Description and Operating Instructions of the HVB-1M machine gun mount and the Mi-6 helicopter armour plating arranged in conjunction with the machine gun.

The Instructions pertaining to the machine gun mount are supplemented by the description of the hydraulic control system of the mount ventral container door panels, the modified pneumatic system of the helicopter as well as the inert gas system.

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Chapter One

DESCRIPTION OF HELICOPTER ARMAMENT

1. General

The armament of the Mi-6 helicopter comprises front machine gun mount HYB-1M with 12.7-mm large-calibre machine gun. The mount is laid manually and has limited traverse and elevation.

The HYB-1M machine gun mount is installed in a special ventral container in the helicopter fore part and is designed for engaging enemy ground targets as well as for firing at air targets by maneuvering the helicopter (Figs 1 and 2).

The container is closed by two rotating door panels which are opened and closed by means of a hydraulic cylinder, the latter being controlled by a special cock placed on the port side under the navigator's rack.

The front flat electrically-heated glass screen of the navigator's cabin enables the navigator to conduct aimed fire from 0 to -50° in elevation and 30° both to the left and to the right.

The HYB-1M machine gun mount is fastened by four bolts to a cylinder-shaped cradle provided with flanges. The cradle rigidly ties up the longerons of the fuselage.

The access to the machine gun is ensured through the open door panels of the ventral container from the outside of the helicopter as well as through the removable cover of the mount jacket from the inside of the navigator's cabin.

The ammunition box is fixed under the right pilot's floor between nose frames No. 6 and No. 7 on a special base plate by means of guiding rails and a stop stud (Figs 3 and 4).

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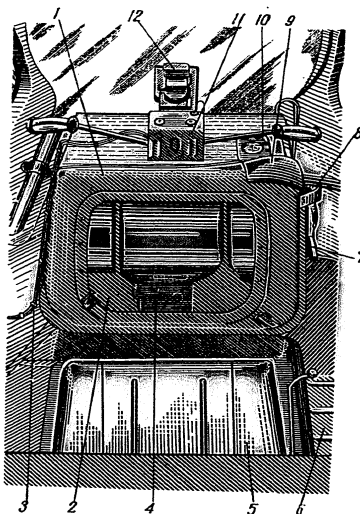


Fig. 1. General View of HVB-1M Machine Gun Mount from Pilot's Cabin

1 — jacket; 2 — rear cover; 3 — electric cable; 4 — machine gun A-12.7; 5 — navigator's seat; 6 — jacket; 7 — electro-pneumatic valve; 8 — rigid chute; 9 — upper cover; 10 — indicator panel; 11 — controls; 12 — collimator sight.

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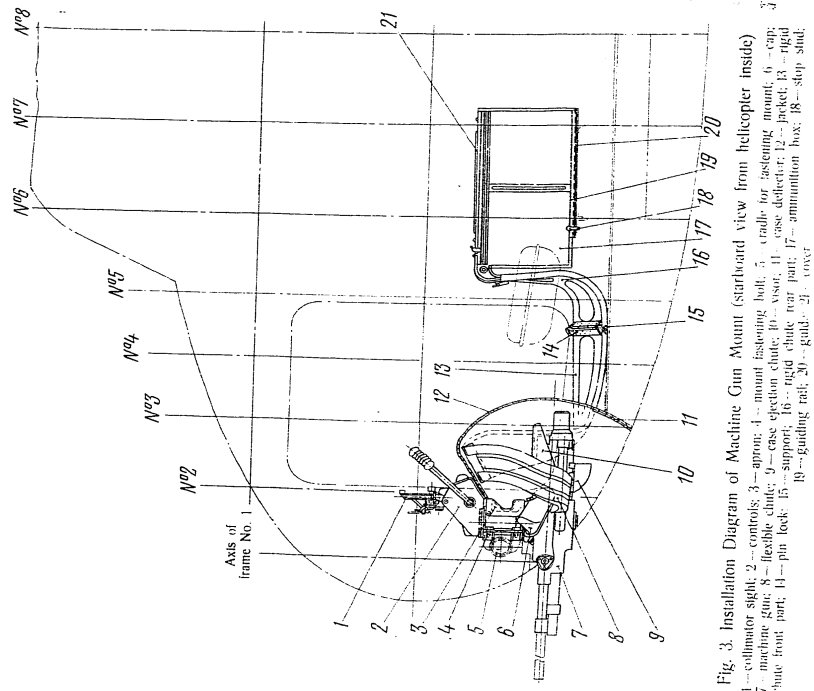


Fig. 3. Installation Diagram of Machine Gun Mount (starboard view from helicopter inside)

1—collimator sight; 2—controls; 3—apron; 4—mount fastening bolt; 5—cradle for adjusting mount; 6—cap; 7—machine gun; 8—flexible chute; 9—case ejection chute; 10—visor; 11—case deflector; 12—pin lock; 13—rigid chute front part; 14—pin lock; 15—support; 16—rigid chute rear part; 17—ammunition box; 18—stop stud; 19—guiding rail; 20—guide; 21—cover

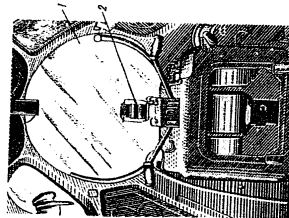


Fig. 2. Navigator's Front Glass Screen

1—front glass screen; 2—collimator sight

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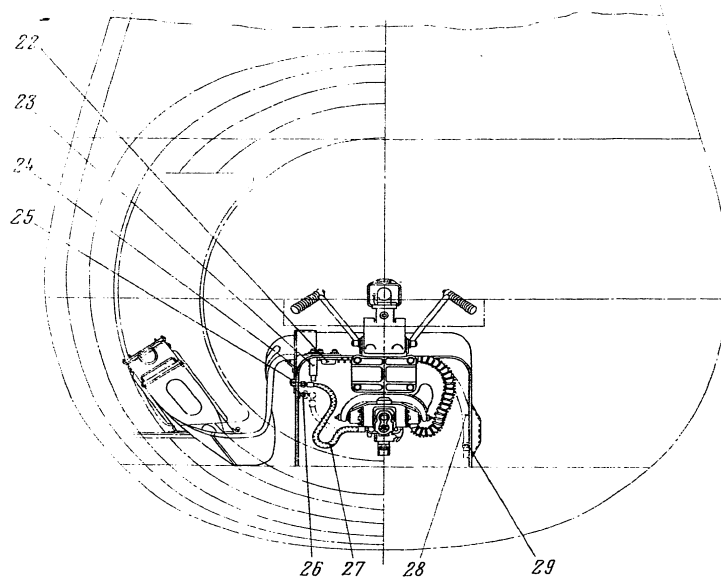


Fig. 4. Installation Diagram of Machine Gun Mount (front view)

22 - pressure gauge; 23 - ammunition counter; 24 - attachment of rigid chute to jacket;
25 - electro-pneumatic valve; 26 - pipe connection of flexible hose stowed position; 27 -
flexible hose (dotted line indicates stowed position); 28 - stowed position of flexible
chute; 29 - belt

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The machine gun is belt fed continuously. The sight is stalled on the mount is of a telescopic type. The machine gun is laid at a target manually. The weapon is charged by means of an electro-pneumatic system. Firing is electrically controlled.

The navigator tracks the target and lays the machine gun with the help of two control grips from a kneeling position. In this case turning the machine gun through the rated angles is possible only when the lock is released, i.e. when the thumb-piece is set in the OPEN (OTKPHTO) position.

The number of loaded and remaining rounds is indicated by the ammunition counter YCB-1.

Fired cases and links are ejected overboard.

2. Basic Specifications

1. Armament. one machine gun A-12,7
 - (a) calibre. 12,7 mm (standard rounds)
 - (b) muzzle velocity... . 827 $\pm$ 10 m/sec
 - (c) weight of round. 43.2 - 44.7 gr
 - (d) weight of case 123 - 135 gr
 - (e) weight of link 28 gr
 - (f) rate of fire, with mains voltage being equal to 27 V, is limited to 900 r.p.m. by energizing electric trigger coil through front limit stop contact (transmitter);
 - (g) recoil force not more than 1400 kg
 - (h) air expenditure for one recharging at an air pressure of 50 kg/sq.cm, with belt containing 60 rounds 15 lit
 - (i) weight of machine gun 28 kg
2. Ammunition stock (normal). 200 rounds^{x)}
3. Maximum traverse and elevation:
 - (a) traverse. $\pm 30^{\circ} \pm 1^{\circ}$
 - (b) elevation $0^{\circ} \pm 1^{\circ}$
 - (c) depression. $-55^{\circ} \pm 1^{\circ}$

^{x)} When utilizing full capacity of ammunition box and chutes the ammunition stock is equal to 270 rounds.

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4. Total weight of mount:
 - (a) with machine gun and ammunition. . . . 84 kg $\pm$ 5%
 - (b) without machine gun and ammunition . . . 30 kg $\pm$ 5%
5. Laying manual
6. Charging electropneumatic
7. Feeding continuous, with belts
8. Ejection of fired cases and links. overboard
9. Sight telescopic, collimator K10-T

3. Construction of Machine Gun Units

Machine Gun Cradle

The machine gun cradle (Fig. 5) is used for fastening the machine gun on the mount.

The cradle body is a trough-shaped cast piece made of magnesium alloy. The horizontal and side walls of the cradle body are reinforced with lugs and ribs.

The coaxial holes in the middle part of the cradle body carry pressed-in bronze bushings 7 (two on either side) which, during the assembly of the machine gun mount, receive half-axes used to hinge the cradle on the yoke.

Pressed coaxially into the front part of the cradle body are bushings 10 and 12 which accommodate special smooth nuts 9 and 13 having slots for machine gun trunnions.

On the inner surface of each bushing there is an annular groove which is aligned with the annular groove on the outer surface of the smooth plug. Both grooves form a race for 37 balls, 2 mm in dia. The balls are inserted into the race through the production hole in the bushings, last ball No. 38 being fitted in to prevent the balls from dropping into the production hole when the nuts are rotated. After pressing the bushing into the cradle the 38th ball is pressed against the cradle body thereby closing the race, while the other 37 balls housed in the annular grooves keep the smooth nuts from moving laterally. Both during assembly and service a la-

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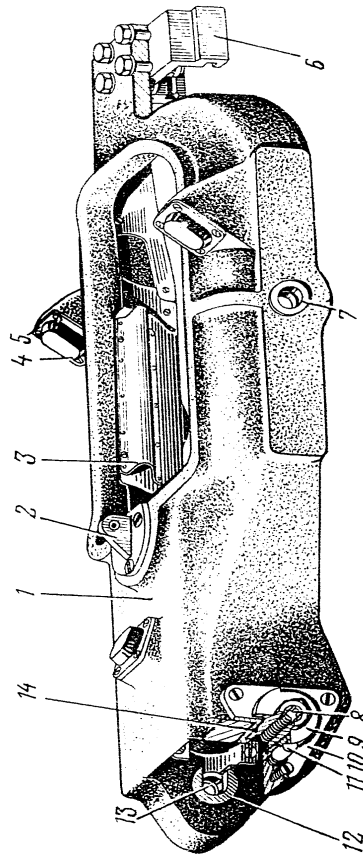
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Fig. 5. Machine Gun Cradle

1 - cradle body; 2 - lug for fastening rod; 3 - deflector; 4 - stop; 5 - strip; 6 - rear attachment; 7 - bronze bushing; 8 - threaded plug; 9 - left-hand nut; 10 - left-hand bushing; 11 - stop; 12 - right-hand bushing; 13 - right-hand nut; 14 - balls.

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teral axial play of the smooth nut within 0.2 mm is permissible.

When installing the machine gun on the cradle, the trunnions are fitted into the sockets of nuts 9 and 13, and the rear guide lugs into the slots of the rear attachment, then nuts 9 and 13 are turned with a special cradle wrench through 180° (the cradle wrench is included into each mount's set). To keep the nuts from working loose they are locked with spring-loaded stops 11 mounted in the right and left bushings. Threaded plugs 8 are used to eliminate the side play during the installation of the machine gun. Upon completing the required adjustment the threaded plugs are lockpinned through the holes in the end faces of nuts 9 and 13.

On the cradle body there are lugs (one in the front part and two on the sides) which mount rubber stops 4 secured by strips 5. Stops 4 absorb the shocks of the cradle against the yoke in extreme positions. Lug 2 secured with three screws is intended to connect rod 1 (Fig. 8) of the machine gun cradle with the controls.

The inner surfaces of the cradle walls are lined with steel straps to protect the walls from damage. The right-hand inner wall of the cradle is provided with a steel deflector which guides the used links downward.

Yoke

The yoke (Fig. 6) is designed to ensure horizontal and vertical rotation of the movable part of the mount. It is made of alloy steel. The yoke cheeks carry welded-in bushings 7 with holes to receive half-axles 2 (Fig. 7) which hinge the machine gun cradle to the yoke. Two stops 5 (Fig. 6) welded to the yoke limit the movement of the cradle with the machine gun to -55° in the vertical plane, while stop 4 limits the traverse of the mount within ±30°.

Yoke pin 3 is used to mount the bracket bearings, splines 2 connecting the yoke with the controls.

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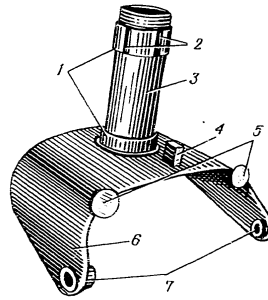


Fig. 6. Yoke

1 — supporting surface for bearings; 2 — splines; 3 — pin; 4, 5 — stops; 6 — yoke cheek; 7 — bushings.

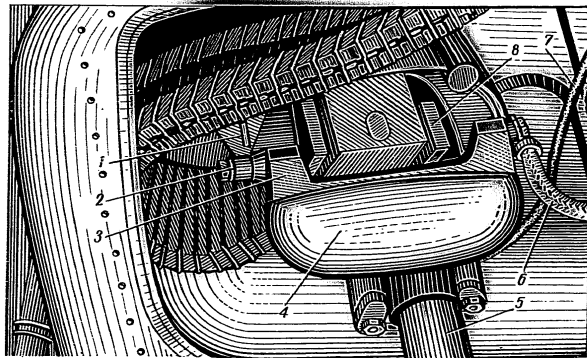


Fig. 7. View of Machine Gun Mount Rear Part (with jacket cover removed)

1 — yoke; 2 — half-axle with nut; 3 — machine gun cradle; 4 — visor; 5 — machine gun; 6 — pneumatic recharging hose; 7 — electric bunched conductor; 8 — deflector.

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Controls

The controls (Figs 8 and 9) are designed to lay the machine gun on the target and to control firing. The controls casing is made of magnesium alloy.

To lay the machine gun in the horizontal and vertical planes provision is made for control grips 16 connected by pin 21 with lever 8. To facilitate the elevation and depression of the weapon pin 21 is installed on needle bearings.

Lever 8 connected to the machine gun cradle through rod 1 forms a power parallelogram, whereas the same lever connected to bracket 14 of the collimator sight attachment through rod 19 forms a laying parallelogram.

Shifting grip 16 in the vertical plane causes lever 8 as well as the machine gun cradle and the bracket with the collimator sight connected with the lever to turn through the same angles due to the similarity between the power parallelogram and the laying parallelogram.

The similarity and accuracy of operation of one parallelogram in relation to the other are obtained by adjusting rod 1 (fine adjustment) and inserting adjusting washers under the ear of lever 8 (basic adjustment).

By rotating the sleeve of rod 1 to either side the rod length is either increased or decreased. This method of adjustment of the rod length ensures the similarity between the power parallelogram and the laying parallelogram. The adjustment of this kind is done only in a shop in compliance with the respective Instructions, then the rod sleeve together with the ears is lockpinned and further adjustment in the vertical and horizontal planes can be performed by turning adjusting bolts on the collimator sight bracket.

The collimator sight bracket is installed on ball bearings in the controls casing and is connected with lever 8 by rod 19. The collimator sight bracket is made of magnesium alloy. To ensure convenient installation and reliable operation, steel plugs and bushings are fitted into the bracket.

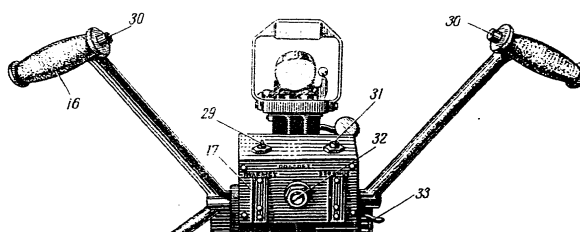
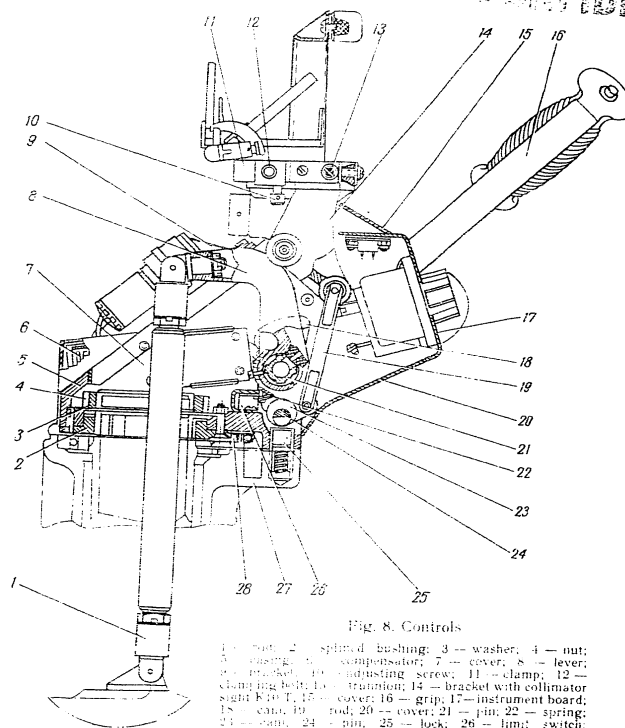
Steel split clamp 11 consists of two hinged cheeks and a

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lock. During the assembly the clamp is fitted on the collimator sight neck and is secured on the casing by two trunnions 13 and two adjusting screws 10. The clamp is locked in position by two clamping bolts 12.

The hinged joint of the clamp on the casing enables the collimator sight to be adjusted in the vertical and horizontal planes. The sight is adjusted by adjusting screws with the help of blocks installed in the clamp sockets and turned onto adjusting screws, the clamping bolts in this case being unscrewed.

The machine gun is laid by turning the controls and consequently the entire mount by means of control grips 16.

The controls casing is locked on the yoke pin (Fig. 6) by nut 4 (Fig. 8).

Due to the bearings pressed in the bracket (Fig. 11) the yoke with the controls and the machine gun cradle hinged to the former are capable of smooth rotation in the horizontal plane.

To protect the bracket upper bearing from penetration of dirt, prior to pressing in splined bushing 2 it is closed with cap 28 (Fig. 8).

To improve laying conditions, instrument panel 17 (Fig. 9) of the controls is provided with lighting rheostat 32 bearing inscription LIGHTING (ПОДСВЕТ) on the plate against it. Lighting rheostat R1 (Fig. 10) is connected to lighting lamp H1 (0.15 A, 26 V) with socket P¹⁰/13-1 or 1119-1. The rheostat is used to regulate the incandescence of the lamp and hence the brightness of illumination of the collimator sight reticle.

Firing is controlled by means of firing buttons 30 (Fig. 9) installed in control grips 16.

The circuits of electric units are connected to the helicopter mains via two circuit breakers A3C-5 and A3C-10 located in the navigator's upper panel and via two switches B-45 AUXILIARY (БОПОМОПАТ.) and MACHINE GUN (МЯМЕТЕ) located in the controls of the HVB-1M machine gun mount.

To open fire one of the buttons B-4 or B-5 (205-K) installed in control grips 16 is pressed; in this case electric trigger K1 is energized (Fig. 10).

Capacitor C-1 (МБПН-3 200 V, 0.5 μ f $\pm$ 10%) connected in

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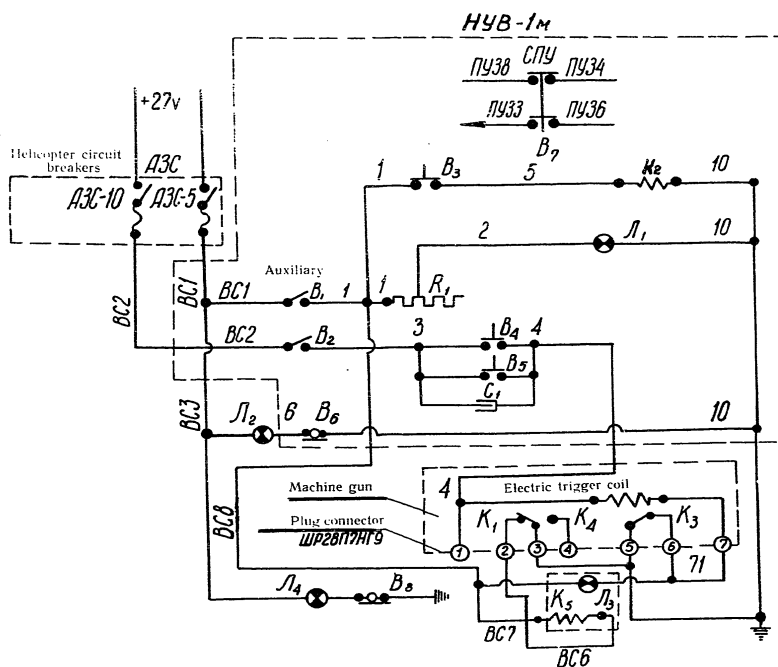
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Fig. 10. Key Diagram of HYB-1M Machine Gun Mount Electric Equipment

A3C-5 and A3C-10 - automatic circuit breakers on navigator's upper panel; B1 and B2 - switches belonging to B-45 of auxiliary and firing circuits; R1 - lighting rheostat of collimator sight K10-T; Л1 - illumination lamp of reticle of collimator sight K10-T; B3 - control button of electro-pneumatic valve; K2 - electro-pneumatic valve 3K-48; B4 and B5 - firing solenoid control buttons; C1 - capacitor; Л2 - stowed position warning lamp CM-30; B6 - stowed position switch KB-9A; Л4 - CONTAINER OPEN lamp CM-30; B8 - switch BF2-140A-1 (operates from container right hand door panel); Л3 - ammunition counter lamp CM-30; K5 - ammunition counter 3CB-1; K4 - transmitter of machine gun recoil group rear position; B7-K4M push-button from interphone set; K1 - transmitter of machine gun recoil group forward position; K3 - readiness transmitter.

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parallel to buttons B-4 and B-5 is placed on the controls wall to quench sparks when switching out the electric trigger and to prevent the button contacts from burning.

For recharging the machine gun it is necessary to press charge button 29 (Fig. 9) for a short time, as a result of which the electro-pneumatic valve K-2 is actuated. Close to the charge button there is inscription RECHARGING (НЕПЕРЕЗАРЯДКА) on the cover.

Lamp H3 (Fig. 10) of the ammunition counter serves to indicate when the machine gun is ready for firing.

Inside the controls house two spring compensators which reduce the effort applied to control grips 16 (Fig. 8) in elevation and depression of the weapon in flight.

As a result of pushing the control grips forward and thereby turning lever 8 with the machine gun in the vertical plane two cams 18 (right and left) rigidly fixed on pin 21 press against the compensator rollers. The compensator rollers in their turn thrust through their sleeves against compensating springs; the compression of the springs compensates for the aerodynamic moment of the machine gun and the effort at control grips 16 does not increase.

Terminal switch 26 placed in the circuit of warning lamp H2 (Fig. 10) which is installed on the indicator panel is used to indicate the stowed position of the machine gun before the take-off or landing.

If the machine gun is in the stowed position, lamp H2 does not light up as spring 22 (Fig. 8) fixed on lever 8 presses the button of terminal switch 26, thus opening the circuit.

The controls are provided with a lock for securing the machine gun mount in the vertical and horizontal planes.

In the stowed position when the machine gun is fixed in the horizontal plane, pin 24 is placed so that the milled slot set against the cheeks of lever 8 is turned downward and lever 8 bears against pin 24 thereby holding the machine gun mount in the vertical plane.

In the combat position pin 24 is turned through 180° by means of a rigidly fixed thumb-piece and the cheeks of lever 8 pass through the slots in pin 24. As a result, the machine

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gun with the sight is enabled to turn through the required angles in the vertical plane.

Lock 25 consisting of two parts - the upper and lower, is pressed by a coil spring from below to cam 23. In the stowed position, when cam 23 is turned upward, the lower part of the lock enters by a half of its height the hole in casing 5, thus preventing the machine gun mount from rotating in the horizontal plane.

In the combat position cam 23 is turned downward and the joint line of the lock lower and upper parts coincides with that of casing 5 and bracket 27. In this case the machine gun mount is capable of turning through rated angles in the horizontal plane.

Note. To facilitate unlocking the machine gun mount it is good practice to apply an effort of about 10 kg to the control grips to obtain play in the locking mechanism.

Bracket

The bracket serves for fastening the HYB-1M machine gun on the mount cradle. The bracket is a cast piece of magnesium alloy (Fig. 11). Its fastening holes carry pressed-in steel bushings, and the upper and lower parts of the sleeve - two bearings 8. The upper part of the sleeve is provided with a lug having a hole to receive pressed-in bushing 4. During the general assembly of the mount this hole is used to accommodate the lock with the spring which locks the machine gun mount in the stowed position.

In the bottom part of the bracket there are two rubber buffers to limit the rotation of the mount in the horizontal plane and to absorb the shocks in extreme positions. A special circular groove machined around the bracket sleeve houses a felt gland protecting the lower bearing from penetration of dirt.

Flexible Chute

The flexible chute of the ammunition supply line (Fig. 12) is a number of telescopically connected links which enable the cartridge belt to reach the machine gun no matter through what angle of the firing sector the machine gun is turned.

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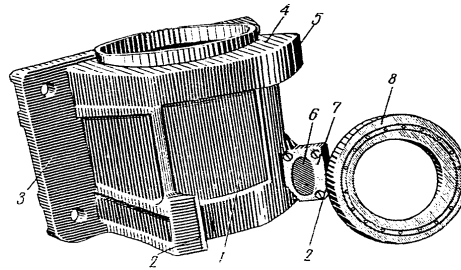


Fig. 11. Bracket with Upper Bearing Removed

1 — bracket; 2 — lugs for stop; 3 — bracket lug; 4 — bushing; 5 — rigid half-ring; 6 — stop; 7 — plate; 8 — bearing.

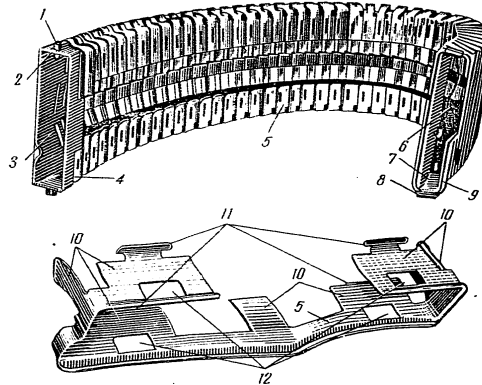


Fig. 12. Flexible Chute

1 — dowel; 2 and 3 — guides; 4 — feedway; 5 — link; 6 — feedway; 7 — lower band; 8 — lug; 9 — upper band; 10 — tongues; 11 — T-shaped lugs to connect links; 12 — rectangular ports for lugs.

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The chute links are stamped of sheet stainless steel; they are C-shaped pieces with a lateral groove pressed along the contour on the side to be connected to the next link. To join the links of the flexible chute to each other they are furnished with T-shaped lugs 11 (pressed outward) and rectangular ports 12. The side tabs of the lugs are bent by 90° to ensure the assembly of the flexible chute.

The links are connected in the following manner: each subsequent link is fitted with unbent tongues 10 into the feedway, and with the T-shaped lugs and bent tabs into the ports of a preceding link, then the side tabs are straightened and the links cannot disengage from each other spontaneously.

Due to a larger size of rectangular ports as compared to the necks of T-shaped lugs entering them, the links have a comparative freedom of movement in relation to each other both in the parallel and perpendicular planes. In case of bending of the chute spring tongues 10 overlap the cracks appearing between the end faces of the links thereby ensuring a smooth travel of the cartridge belt.

The flexible chute is jointed to the rigid chute by means of feedway 4 which is a welded box with link 5 attached to it by point welding. On the sides of the welded box there are two dowels 1 by means of which the flexible chute is connected to the rigid one. The feedway has guides 2 and 3 on the inner surface to facilitate the movement of the cartridge belt.

On the machine gun side the lugs of the last link of the flexible chute engage the ports of feedway 6 which is a shaped box with welded-on upper band 9 and lower band 7 and two lugs 8 for attaching feedway 6 to the machine gun receiver feedway. The feedways are fixed by two shafts locked by pins.

Through the ports of feedway 6 the first cartridge from the cartridge belt is pushed with a screwdriver behind the feed-pawls of the machine gun receiver.

Rigid Chute

The rigid chute connects the ammunition box with the flexible chute. The chute is made of sheet duralumin alloy and

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forms a bent split casing running with its middle part under the threshold of the navigator's door

The front part of the rigid chute (Fig. 13) is fixed by bolts on the mount casing bracket and is additionally fastened by thrusting against a textolite padding secured to the floor of the navigator's cabin under the door threshold.

The rigid chute rear part (Fig. 14) is hinged by quick-release pin locks. The joint of the rigid chute is necessary to allow access to the ammunition box when loading it with a cartridge belt.

In the upper wall of the rigid chute there are elongated ports through which the cartridge belt can be guided to the machine gun during loading. The inside surface of the rigid chute is lined with steel straps to prevent friction of the sharp parts of cartridge belt links against the chute duralumin walls.

On the side of the flexible chute the rigid chute is provided with flat springs with holes which engage the flexible chute dowels. Spring limiters keep the springs from breakage during service.

Removable jacket 8 (Figs 13 and 14) closes the rigid chute and protects it from damage.

Rigid chute pin locks are made of steel. A spring housed inside the lock body tends to force out pins 3 (Fig. 14). Studs 2 screwed into the pins serve as handles for opening the lock and for fixing the pins in the open position.

Ammunition Box

The ammunition box (Fig. 15) is a case made of riveted sheet aluminium alloy. Its steel neck has a pin with rollers to facilitate the movement of the cartridge belt and a window for fitting it into the rigid chute. A quick-release cover is fastened by a latch on one side and by a pin lock on the other. The rigid construction of the box is ensured by additional straps and grooves.

Two lower steel guiding rails riveted to the side walls are used for installing the ammunition box in the helicopter.

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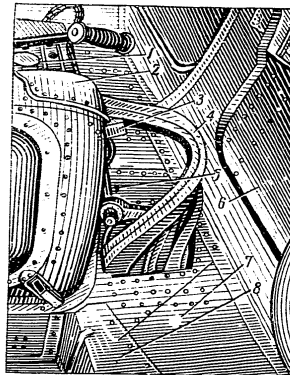


Fig. 13. View of Rigid Chute Front Part

1 -- indicator panel; 2 -- upper cover; 3 -- jacket bracket; 4 -- rigid chute; 5 -- manual control handle of electropneumatic valve; 6 -- navigator's door; 7 -- door threshold; 8 -- removable jacket

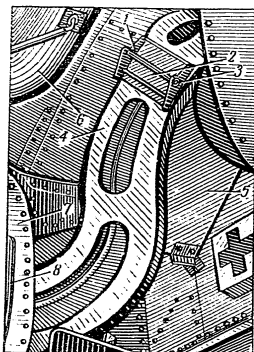


Fig. 14. View of Rear Part of Rigid Chute and Ammunition Box

1 -- pin lock; 2 -- stud; 3 -- pin; 4 -- rigid chute; 5 -- ammunition box; 6 -- navigator's door; 7 -- door threshold; 8 -- removable jacket

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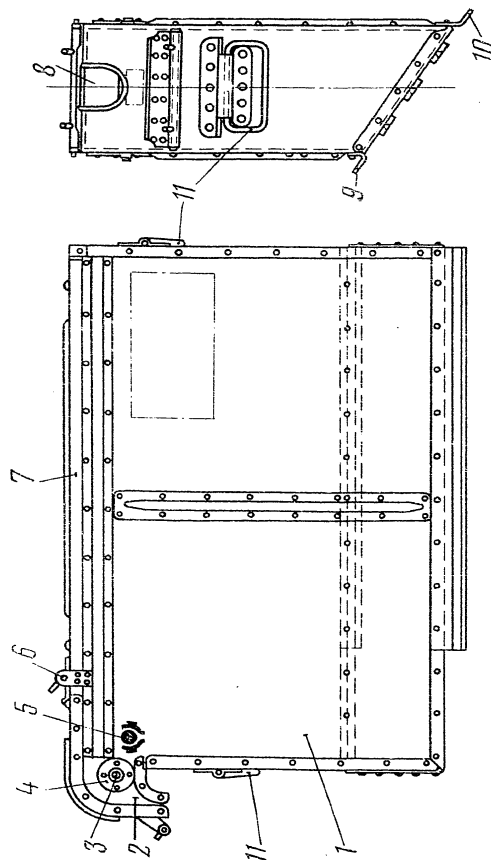
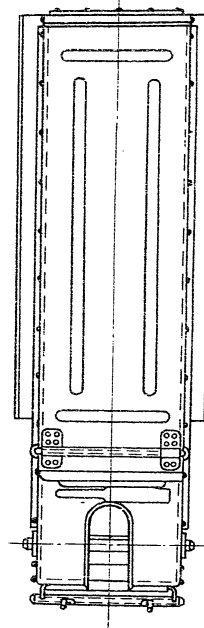


Fig. 15. Ammunition Box
 1 - box; 2 - neck; 3 - pin with rollers; 4 - pin bushing; 5 - cartridge; 6 - movement sign; 7 - pin lock; 8 - handle; 9 - pin; 10 - carrying handle; 11 - carrying handle.

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The box is locked in position by a lock stud run through the left-hand guide rail and the bearing bracket.

Jacket

The jacket of the HYB-1M machine gun mount is an air-tight cover protecting the navigator and his cabin from the contrary stream of air and powder gases during firing. The jacket is manufactured of sheet duralumin alloy and has a lateral joint allowing its installation and dismantling in the helicopter.

The jacket is fastened to the fuselage by screws and retaining nuts. The jacket neck adjacent to the machine gun mount bracket is edged with contour-shaped rubber strip.

For convenience of feeding the cartridge belt into the machine gun the jacket has two quick-release covers: upper and rear. The upper cover is attached by four shaped dowels to the jacket spring clamps, while the rear cover is suspended from hooks 2 (Fig. 16) and secured by two locks with a spring detent.

To improve observation with door panels opened the rear cover is glazed with organic glass. Covers-to-jacket joints are lined with contour-shaped rubber strips.

Recess 10 is made to fit the rotating thumb-piece of the machine gun lock. Jacket bracket 3 (Fig. 13) serves as a support for the rigid chute. Inside the bracket there are four retaining nuts into which rigid chute fastening bolts are screwed.

Case Ejection Chute

The case ejection chute (Fig. 17) is welded box 1 made of alloy steel. It has four lugs with longitudinal slots by which it is fitted on the lower guides of the machine gun and is locked in that position by a cotter engaging stop 4.

Machine Gun Recharging Pneumatic System

The HYB-1M machine gun mount is equipped with an electro-pneumatic recharging system (Fig. 18).

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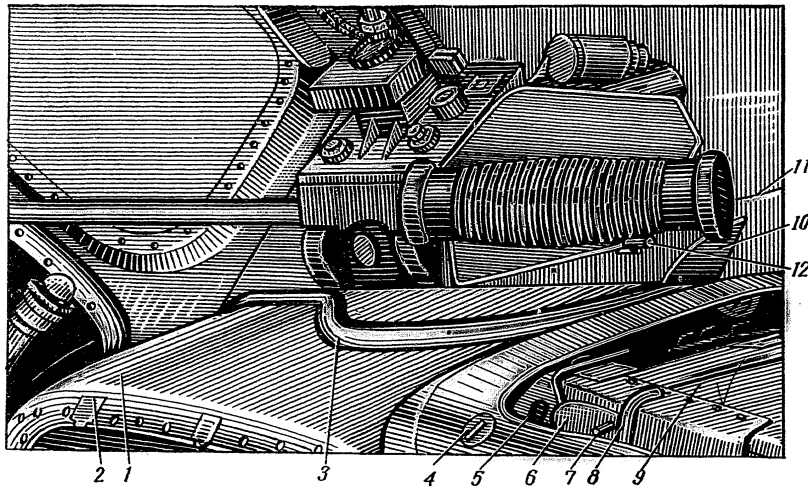


Fig. 16. View of Mount Jacket with Upper Cover Removed

1 — jacket; 2 — hook; 3 — stiffening rib; 4 — clamp; 5 — flexible chute; 6 — flat spring; 7 — pin; 8 — limiter;
9 — rigid chute; 10 — recess; 11 — jacket joint; 12 — thumb-piece.

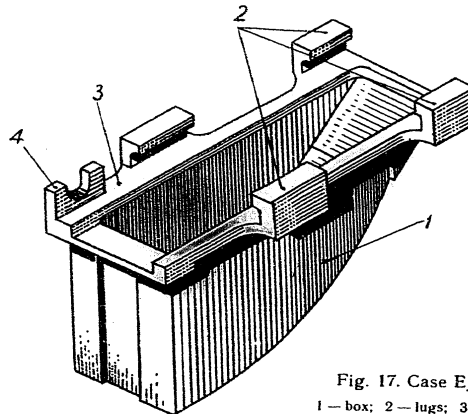


Fig. 17. Case Ejection Chute

1 — box; 2 — lugs; 3 — base; 4 — stop.

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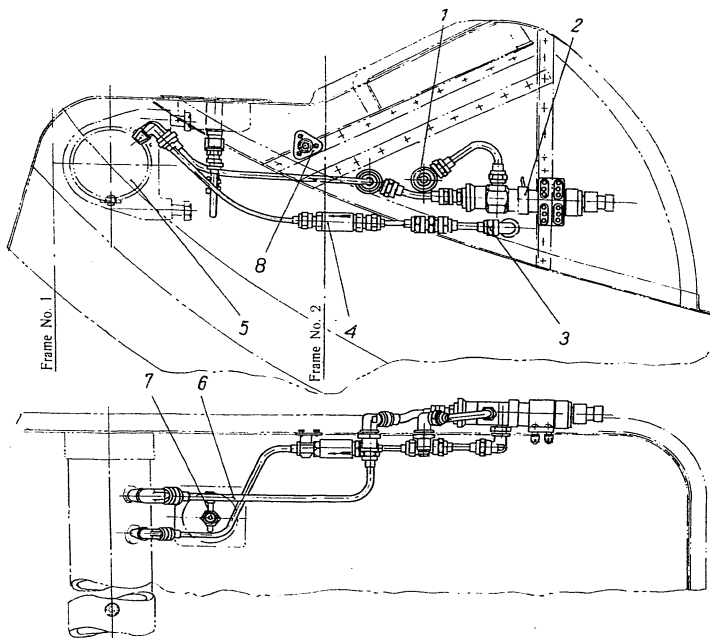


Fig. 18. Pneumatic System

1 — flexible hose pipe connection; 2 — electro-pneumatic valve ЭК-48; 3 — compressed air pipe line from helicopter pneumatic system; 4 — nonreturn valve; 5 — compressed air bottle; 6 — compressed air pipe line to electropneumatic valve; 7 — sleeve for pressure gauge on indicator panel; 8 — screw plug.

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The pneumatic system includes: compressed air bottle, electro-pneumatic valve 3K-48, pressure gauge for 100 kg/sq.cm, nonreturn valve 998A-4, pipe lines and flexible hose for connecting to the machine gun.

Cradle - Compressed Air Bottle

The inner space of the HVB-1M machine gun mount cradle is used as a compressed air bottle. The cradle is a cylinder-shaped piece provided with flanges (Fig. 19) by which it is bolted to the helicopter longerons.

Two yokes 3 welded to the compressed air bottle have bosses for attaching the bracket of the HVB-1M machine gun mount. Threaded holes 6 are used to receive pipe connections of the pneumatic system. Hole 5 closed with a screw plug is designed for draining condensate periodically during the machine gun service.

The compressed air bottle is charged to a pressure of up to 50 kg/sq.cm through nonreturn valve 998A-4 from bottle 24 (Fig. 39) of the L.G. right-hand shock-absorber leg.

Electro-Pneumatic Valve

Electro-pneumatic valve 3K-48 is designed to feed air into the pneumatic cylinder for recharging the machine gun. The valve is mounted inside the navigator's cabin on the right-hand side of the machine gun mount jacket.

The air supply is started after pressing the charging button when the solenoid coil of the electro-pneumatic valve is energized, or by pressing manual control handle 5 (Fig. 13).

The repair of the electro-pneumatic valve is forbidden. A faulty valve should be replaced by a new one.

Basic Specifications of Electro-Pneumatic Valve 3K-48

Valve capacity at pressure of 50 kg/sq.cm..	300 lit/sec
Maximum operating pressure.....	60 $\pm$ 5 kg/sq.cm
Solenoid operating voltage.....	27 V $\pm$ 10%
Solenoid core travel.....	1.7 mm
Weight	420 gr

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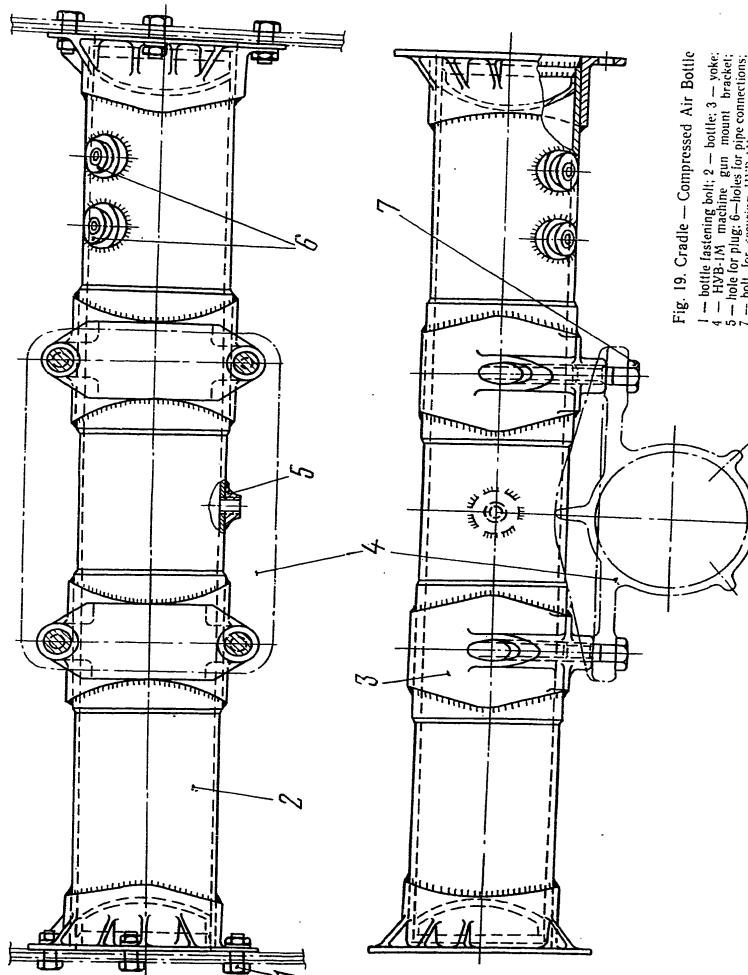
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Fig. 19. Cradle — Compressed Air Bottle
 1 — bottle fastening bolt; 2 — bottle; 3 — yoke;
 4 — HYB-1A machine gun mount bracket;
 5 — hole for pipe connections;
 6 — plug; 7 — holes for securing HYB-1A machine gun mount with locking wire

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The electro-pneumatic valve (Fig. 20) consists of the following main parts: valve casing 17, solenoid body 11, outlet valve 16, pipe connection 21, servo-valve 15, piston 4, cylinder head 7, solenoid 9, and plug connector 3HKP-1.

Valve casing 17 houses screwed-in pipe connection 21. Plug connector 3HKP-1 is coupled with the solenoid body by means of a union nut.

A threaded joint interlocks inlet valve 19 with outlet valve 16.

Outlet valve rod 2 carries spacer bushing 18 bearing with its one end against the packing washer of the inlet valve, and with the other end, against the packing washer of the outlet valve. Inlet valve 19 is pressed by spring 20 and the air pressure to the valve seat.

Piston 4 with packing rings 5 is installed on the outlet valve rod and secured with nut 6.

The compressed air from the bottle flows via pipe connection 21 into the inlet valve chamber and fills the inner space of the rod.

In the solenoid limiter socket there is spring 8 which, besides pressing against the solenoid core, bears against bushing 14 with soldered-in tie-rod 12 of the servo-valve.

The servo-valve is pressed by its rubber washer 3 to the seat of the inlet valve rod, thus barring the way to the air in the rod inner space.

On pressing the button marked on the controls panel with inscription RECHARGING (ПЕРЕЗАРЯДКА) the solenoid circuit is energized. The solenoid core is drawn in, compresses spring 8 and pushes the servo-valve away from the seat. The servo-valve closes with its spherical lug the hole in the head of cylinder 7 thus preventing the escape of the air into the atmosphere.

As the area of the piston is much greater than that of the outlet valve, the compressed air pressing against the piston overcomes the effort of spring 20 and the air pressure upon the inlet valve and shifts the entire assembly to the left. The inlet valve opens, while the outlet valve closes and the

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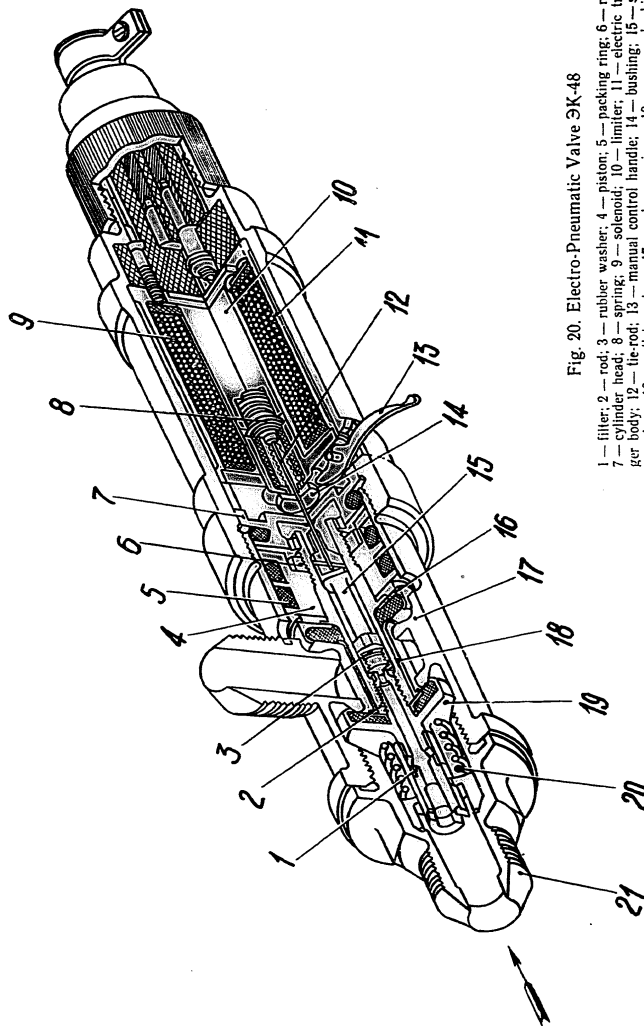


Fig. 20. Electro-Pneumatic Valve 3K-48

1 — filter; 2 — rod; 3 — rubber washer; 4 — piston; 5 — packing ring; 6 — nut;
 7 — cylinder head; 8 — spring; 9 — solenoid; 10 — limiter; 11 — electric trig-
 ger body; 12 — tie-rod; 13 — manual control handle; 14 — bushing; 15 — se-
 vo-valve; 16 — outlet valve; 17 — valve casing; 18 — spacer bushing;
 19 — inlet valve; 20 — spring; 21 — pipe connection.

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compressed air flows into the machine gun recharging pneumatic cylinder through the outlet pipe connection and the pipe line.

As the solenoid circuit is deenergized, the servo-valve, under the action of spring 8, cuts off the flow of air through the valve rod and opens the outlet valve in the head of cylinder 7. The compressed air in the cylinder chamber passes through the outlet hole in the cylinder head and through the hole in the casing into the atmosphere, the air pressure in the cylinder chamber drops and all movable parts of the pneumatic valve assume the initial position: the inlet valve closes, the outlet valve opens and the used air flows outside.

The electro-pneumatic valve can also be opened by hand by pressing manual control handle 13. Pressure on the manual control handle causes the solenoid core and the servo-valve to withdraw; further operation of the pneumatic valve proceeds as described above.

The electric current is fed to the solenoid coil through the plug of double-pin plug connector ЭМКР-1, the plug being secured on the solenoid body.

The operation of electro-pneumatic valve ЭК-48 is illustrated in Fig. 21.

Controls Panel

Indicator panel 10 (Fig. 1) fastened to the machine gun mount jacket is designed to supervise the operation of the НВБ-1М machine gun mount.

The duralumin panel mounts: pressure gauge for 100 kg/sq.cm, ammunition counter УСБ-1 and the sockets for two lamps СЛН-51 with white (left-hand) and green (right-hand) light filters. The lamps are indicated with stencilled inscriptions STOWED POSITION (ПОХОДНОЕ ПОЛОЖЕНИЕ) and CONTAINER OPEN (ЯЩИК ОТКРЫТ).

The ammunition counter coil is connected to transmitter К1 of the forward position of the machine gun recoil group, while its lamp Л3 (Fig. 10) is connected to readiness trans-

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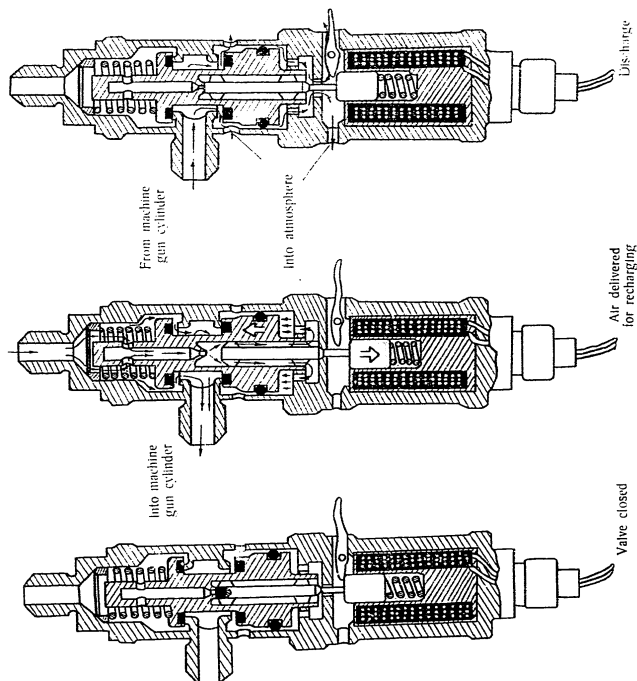


Fig. 21 Functioning of Electro-Pneumatic Valve, Diagram

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mitter K3 which is closed when the machine gun recoil group reaches the forward position.

During firing the ammunition counter lamp is blinking as the rearward movement of the recoil group by 35% of the entire recoil length causes the readiness transmitter to open the circuit.

Lamp J2 with the white light filter is connected with the terminal switch of the machine gun controls. It lights up in the firing position and goes out when the weapon is placed in the stowed position. Lamp J4 with the green light filter is connected with the terminal switch of the ventral container door panels. The lamp lights up when the door panels are opened and vice versa.

Cover

The cover (Fig. 22) fixed to the upper part of the yoke pin (Fig. 6) protects the gunner from the contrary air stream and the mount from dirt.

The cover consists of cover proper 2 sewn with flaxen threads of semi-flax combination canvas, nut 3 made of aluminium alloy and ferrule 4 manufactured of sheet duralumin. To increase rigidity ring 1 made of sheet duralumin is fitted into the upper part of the cover. The cloth is unbent and stitched.

In the lower part of the cover the cloth is inserted between the flange of nut 3 and ferrule 4 and riveted. During the assembly the nut is screwed into the upper portion of the pin of yoke 3 (Fig. 6) and rod 1 is run through the hole in the nut and the opening of the cover (Fig. 8).

Placing Flexible Chute and Flexible Hose in Stowed Position

When removing the machine gun from the mount, the flexible chute and the hose of the pneumatic system should be placed in the stowed position to avoid their damage and choking. The flexible chute is fastened with belt 29 (Fig. 4) on the left wall of the ventral container, and the flexible hose of

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the pneumatic system is screwed with its free end onto pipe connection 26 installed inside the jacket.

4. Electric Equipment

Circuit Breakers, Types A3C-5 and A3C-10

The A3C-5 and A3C-10 circuit breakers (Fig. 23) are designed for switching on and off manually the machine gun mount electric circuits as well as for automatic disconnection of the mount circuits from the mains in case of short-circuit.

After the operation of the circuit breaker as a result of a short-circuit, determine the cause of the trouble and switch on the circuit breaker by hand.

The A3C-5 and A3C-10 circuit breakers comprise a split plastic case, a single-pole lever switch fitted in the case upper part, and a bimetallic sensitive element connected in series with the switch contacts. The end face of the switch lever is coated with luminous compound to ensure orientation in darkness.

Basic Specifications of Circuit Breakers, Types A3C-5 and A3C-10

Rated current	$I_H = 5$ A for A3C-5 $I_H = 10$ A for A3C-10
Pickup current	$1.2 - 1.5 I_H$
Clearing time with $2I_H$ current and ambient temperature $+20^\circ\text{C}$	30 - 55 sec
Weight.....	90 - 100 gr

It is forbidden to disassemble or repair the circuit breaker. In case of damage the defective circuit breaker should be replaced by a new one.

Capacitor MBPH-3

Capacitor MBPH-3 200 V, 0.5 $\mu\text{f} \pm 10\%$, paper, air-tight is assembled in a metal case and has two contact leads (Fig. 24).

The capacitor is intended for spark quenching and for

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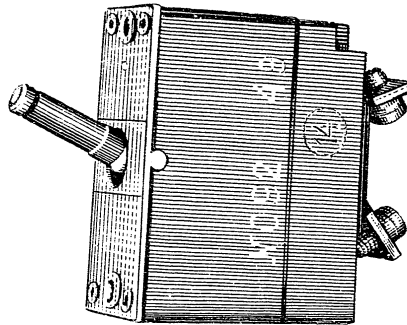


Fig. 23 Circuit Breaker

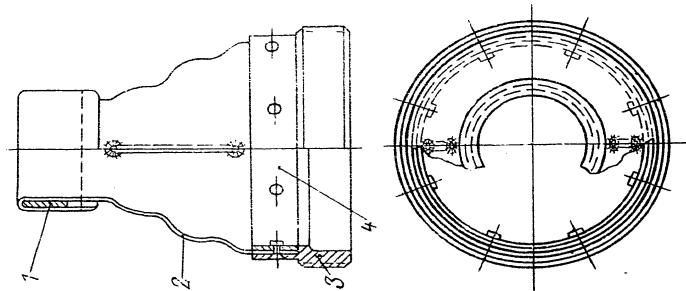


Fig. 22. Cover

1 — ring; 2 — cover; 3 — nut; 4 — ferrule.

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facilitating the operation of the contact system of the switches (B-4 and B-5 of the controls) energizing the firing circuit.

Specifications

Rated capacity..... 0.5 μ f
 Operating voltage..... 200 V
 Number of contact leads..... 2

It is forbidden to disassemble and repair the capacitor.
 A defective capacitor should be replaced by a new one.

Terminal Switch KB-9A

The terminal switch installed on the machine gun mount is used for switching on the stowed position warning light on indicator panel 1 (Fig. 13).

On the machine gun mount the KB-9A terminal switch operates as a switch with normally closed contacts.

Split plastic case 1 (Fig. 25) houses a contact system including flat spring 6 and four contact plates 5 and 8 with outside leads. The flat spring is provided with two double-sided contacts and two lugs, the latter entering the slot of thrust plate 9 pressed by return spring 7.

The case is closed by cover 2 and is held in the closed position by two aluminium rivets 4.

When pressing terminal switch push-button 3, the flat contact spring is forced by its lugs to shift from one position to the other. At the same time after releasing the push-button from the outside pressure, the compressed return spring returns the flat spring to the initial position.

It is forbidden to disassemble or repair the KB-9A terminal switch. A defective terminal switch should be replaced by a new one.

Specifications of Terminal Switch KB-9A

Voltage..... 27 V
 Current 10 A
 Push-button complete travel..... 1.5 mm

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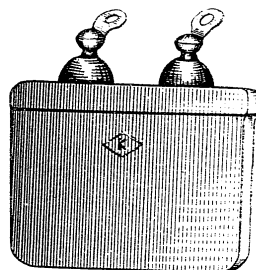


Fig. 24. Capacitor MBFT-3,
200 V, 0.5 μ F $\pm$ 10%

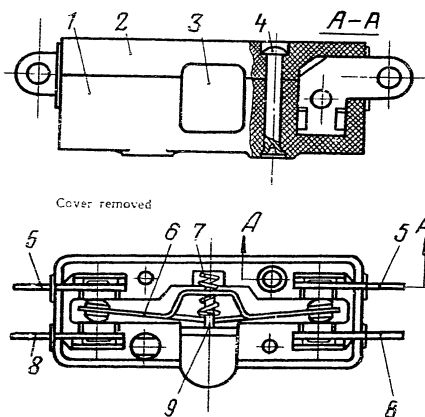


Fig. 25. Terminal Switch KB-9A

1 -- case; 2 -- cover; 3 -- push-button;
4 -- rivet; 5 and 6 -- plates with
outside leads; 6 -- flat spring; 7
spring; 9 -- plate.

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Push-button operating travel..... 1 mm
 Effort applied to push-button not to exceed 450 gr

Four-Contact Push-Button K4M

A small size four-contact push-button K4M (Fig.26) is designed to switch on the interphone system. The push-button is installed on controls panel.

Plastic case 2 accommodates four fixed spring contacts 1 with outside leads.

Two contacts 4 manufactured in the shape of insulated segments are placed in the grooves of plastic head 3 and are used to close fixed contacts 1 in pairs after applying pressure to the head.

Head 3 houses pressed-in steel rod 7. The head is guided in the case by grooves and bronze bushing 8.

Bushing 5 loosely fitted on rod 7 is designed to insulate contacts 4 and 1 from each other and both the contacts from the rod and spring 6.

The circular groove on the head end face is filled with luminous compound to facilitate operation in darkness.

It is forbidden to disassemble and repair the push-button using the organization facilities. A defective push-button should be replaced by a new one.

Basic Specifications

1. DC voltage..... up to 30 V
2. Current 1.5 A
3. Push-button head travel..... 3.5 - 4.8 mm
4. Effort applied to switch on
push-button..... 1 - 2.5 kg
5. Weight not more than 8 gr

Push-Button 205-K

The 205-K push-button (Fig.27) is a single-pole switch. One push-button is included into the circuit of the machine gun mount recharging circuit, while the two others are placed in the firing solenoid circuit, the latter being used for

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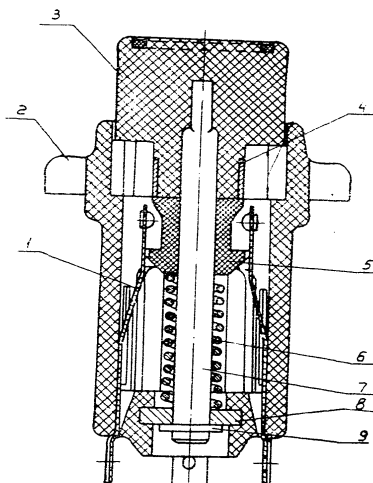


Fig. 26. Four-Contact Button K4M

1 — fixed contact; 2 — body; 3 — head; 4 — head contact; 5 — bushing; 6 — spring; 7 — rod; 8 — bushing; 9 — spring washer.

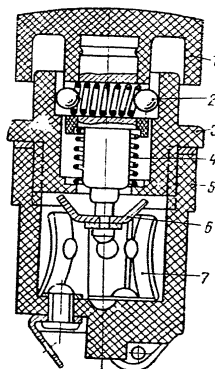


Fig. 27. Push-Button 205-K, Sectional View

1 — push-button head; 2 — ball; 3 — body; 4 — spring; 5 — socket; 6 — movable contact; 7 — spring contact.

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firing. The push-button has three spring contacts 7 which are simultaneously closed by movable contact 6, when the head of push-button 1 is pressed. After releasing the pressure on the push-button, spring 4 returns the push-button head with the movable contact to the initial position. Two balls 2 pressed against the wall by a spring indicate the push-button OFF position with a click. Body 3, socket 5 and push-button head 1 are made of plastic.

Basic Specification of Push-Button 205-K

Rated voltage..... 27 V $\pm$ 10%
 Rated current up to 20 A
 Weight..... 12 gr

Should the 205-K push-button get damaged, it must be as a rule replaced by a new one. However, in case of emergency it may be disassembled by screwing the body out of the socket with extreme care to avoid damage.

5. Collimator Sight, Type K10-T

The K10-T collimator sight (Fig. 28) is used for aiming at ground and air targets when firing from the helicopter. The collimator sight is provided with daylight illumination which renders unnecessary the use of electric light during the operation in the daytime. However, for operation at night, in the dusk or fog there is an electric light with a lamp 0.15 A and 26 V having a light filter and a rheostat for adjusting illumination brightness.

K10-T Collimator Sight Basic Specifications

D i m e n s i o n s

Height..... 120 mm
 Length with electric light..... 115 mm
 Length without electric light..... 82 mm
 Width..... 90.5 mm
 Weight with electric light..... 620 gr
 Weight without electric light..... 435 gr

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Optical Data

Objective focal distance.....	61.47 mm
Objective diameter.....	40 mm
Range finder small graduation value.....	10 mils
Range finder large graduation value.....	20 mils
Angular value of reticle small circle radius	4°36' (80 mils)
Angular value of reticle large circle radius.....	6°53' (120 mils)
Distance of eye pupil from objective opti- cal axis (See Fig. 29):	
for reticle small circle.....	L = 240 mm
for reticle large circle.....	l = 155 mm

Optical System of Collimator Sight

The light beam from the target background falls upon sight reticle 2 (Fig. 29). The reticle placed in the objective focal plane is drawn in transparent lines on the silver-plated and varnished surface of the glass. Mirror 1 refracts the sight optical axis by 90° and the reticle image seen through mirror 1, objective 3 and reflector 4 seems to the gunner's eye to be shifted forward, that is to the side from which the reticle itself is illuminated in the daytime.

The reflector is a plano-parallel glass plate with chrome-plated reflecting surface. Due to the proper selection of reflection and transmittance factors the reticle and the target are distinctly visible in the daytime without any electric illumination.

When firing at a target located against a brightly lit background, hinged light filter 5 is used; in all other cases the light filter is disengaged.

During the operation in the dusk or at night the electric light with light filter 6 should be used (Fig. 30).

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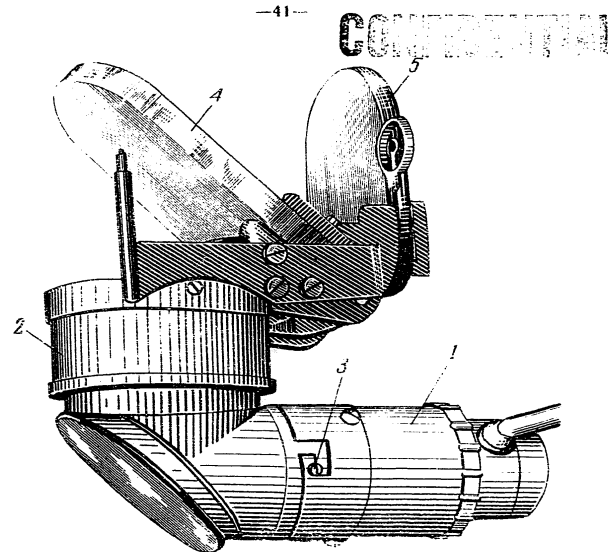
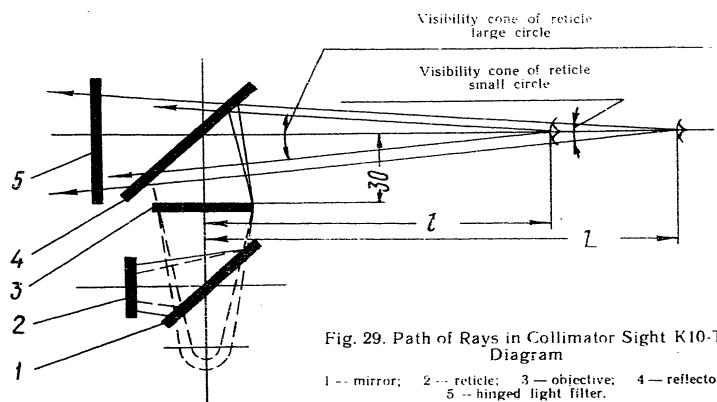


Fig. 28. Collimator Sight K10-T with Electric Light

1 — electric light; 2 — collimator sight body; 3 — pin for bayonet lock;
4 — reflector; 5 — light filter.

Fig. 29. Path of Rays in Collimator Sight K10-T.
Diagram

1 — mirror; 2 — reticle; 3 — objective; 4 — reflector;
5 — hinged light filter.

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Employment of K10-T-20 Collimator Sight

Due to identical dimensions and very slight difference between optical data of collimator sight K10-T and K10-T-20 the K10-T-20 sight can be readily employed in the absence of the K10-T sight.

While laying by means of K10-T-20 sight, it should be borne in mind that as a result of different focal distances of the objectives, different angular values of a small circle radius and different angular values of a large circle radius, the radius of the K10-T-20 sight large circle is greater than that of the K10-T sight large circle by $\Delta R=1.03$ mm. Consequently, the reduction of the large circle radius by 1.03 mm for the K10-T-20 sight will make identical the solution of sighting problems for both sights. In view of the fact that the target movement speed is determined by eye, to all intents and purposes both sights are equal.

For firing at ground targets reticle range measuring scales of both sights may be used:

For 400-m range:

one small graduation of range measuring reticle equalling
10 mils corresponds to $V_{tgt}=35$ km/hr
one large graduation of range measuring reticle equalling
20 mils corresponds to $V_{tgt}=70$ km/hr

For 200-m range:

10 mils correspond to $V_{tgt}=37.2$ km/hr
20 mils correspond to $V_{tgt}=74.4$ km/hr

When strafing enemy infantry it is advisable to fire without lead sighting through the cross-hairs of sighting circles.

When firing at targets moving at a speed of $V_{tgt}=35 - 37$ km/hr a lead equalling one small graduation of the reticle should be taken during sighting, while for the target speed of $V_{tgt}=70 - 75$ km/hr the lead should correspond to one large graduation of the reticle.

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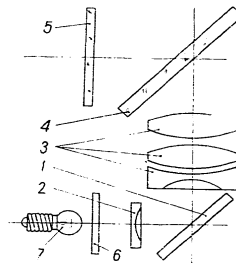
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Fig. 30. Optical System of Collimator Sight K10-T

1—mirror; 2—reticle; 3—objective;
4—reflector; 5—hinged light filter;
6—light filter; 7—lamp.

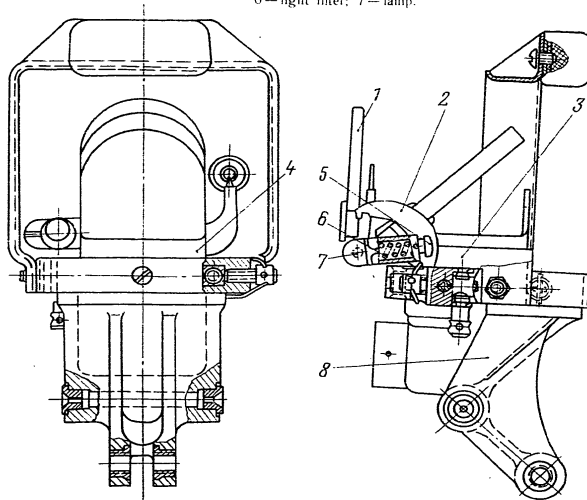


Fig. 31. Collimator Sight with Bracket

1—light filter; 2—clamp; 3—collimator sight body; 4—mounting; 5—latch; 6—spring;
7—light filter hinge pin; 8—bracket.

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Hinged Light Filter Mechanism

The hinged light filter is designed to eliminate the blinding effect of the sun rays when sighting in the direction of the Sun at a background of brightly lit clouds, snow or the shine of the water surface.

The hinged light filter mechanism (Fig. 31) consists of the following parts: light filter 1 fixed in mounting 4, light filter hinge pin 7, latch 5, spring 6 and clamp 2 rigidly secured on body 3 of the collimator sight.

When pressing the latch thumb-piece its tooth disengages the clamp groove thus enabling the mounting secured on the hinge pin to rotate freely along the circumference in the ears of the collimator sight body. In this way the light filter can be swung from one extreme position to the other.

The light filter travel is limited by two lugs on the clamp. As the latch is released, the light filter is locked in one of its extreme positions by the latch tooth which enters the clamp groove under the action of the spring.

Electric Light

For operation at night or in the dusk the collimator sight set includes a removable electric light for illuminating the reticle.

The electric light comprises the following main parts (Fig. 32): a housing, cover, replaceable socket (P¹⁰/13-1 or IM9-1 type), electric lamp 0.15 A, 26 V (with base P¹⁰/13-1 or IM9-1 type), electric cord and socket holder.

If it is necessary to replace socket P¹⁰/13-1 by socket IM9-1 or vice versa the following procedure should be used: unscrew housing 4 from sleeve 5; remove electric lamp 7; unscrew replaceable socket 6 and screw in a new socket.

The assembly of the electric light should be done in the reverse order.

Light filter 8 set in front of lamp 7 is painted gray-green, with the central part painted more thickly to ensure

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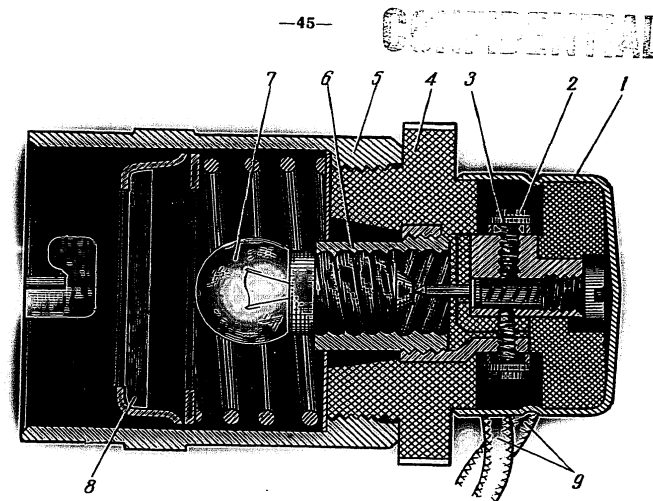


Fig. 32. Electric Light, Sectional View

1 — cover; 2 — screw; 3 — spring washer; 4 — housing; 5 — sleeve; 6 — replaceable socket; 7 — lamp; 8 — light filter; 9 — electric cords.

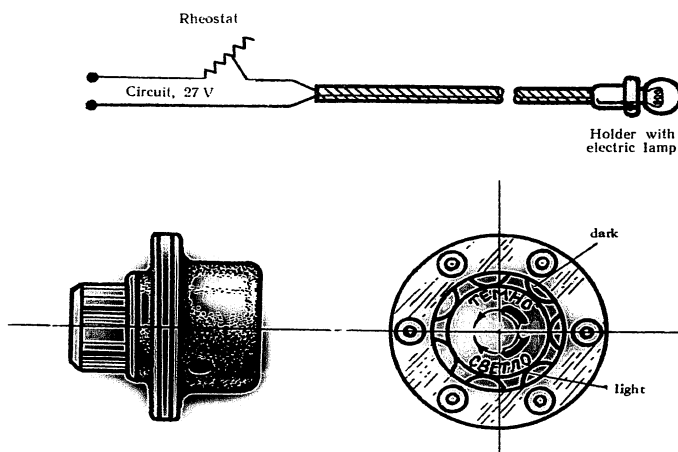


Fig. 33. Electric Light Rheostat and Connection Diagram

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uniform illumination of the sight reticle in conditions of poor lighting.

Electric light sleeve 5 is provided with bayonet slots by which it is secured on the pins of the collimator sight body.

The rheostat with a 400-ohm resistance (Fig. 33) installed on the controls panel is used to adjust the illumination brightness of the sight reticle within a wide range.

For daytime operation the electric light should be removed from the collimator sight body and secured on the stowed position bracket.

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Chapter Two

1. Hydraulic System of
Machine Gun Mount Ventral Container
Door Panels Control

The door panels of the machine gun mount ventral container are opened and closed hydraulically by means of cock 62 (Fig.34) and hydraulic cylinder 63 with a ball lock. The cock and the cylinder are connected to the auxiliary hydraulic system of the helicopter. Fig.35 shows the lay-out of these units on the helicopter.

The liquid flows to the cock from reducing valve PA-159 at a pressure of 60 kg/sq.cm. When turning the cock handle the liquid passes into a respective space of hydraulic cylinder 2 (Fig.36) which closes or opens the door panels of the ventral container. The purpose of the ball lock of the hydraulic cylinder is to keep the door panels closed to prevent them from opening spontaneously in case of pressure drop in the hydraulic system.

Door Panels Control Cock

The cock (Fig.37) consists of bronze body 3, steel slide valve 4 with distribution passage-ways in the end face and a through hole, cap 5, pin 2, and handle 1.

With the handle set in the neutral position, the liquid flowing into pipe connection 1 presses slide valve 4 to body 3 thus closing the hole. In this position three pipe connections II, III and IV are connected to each other, that is

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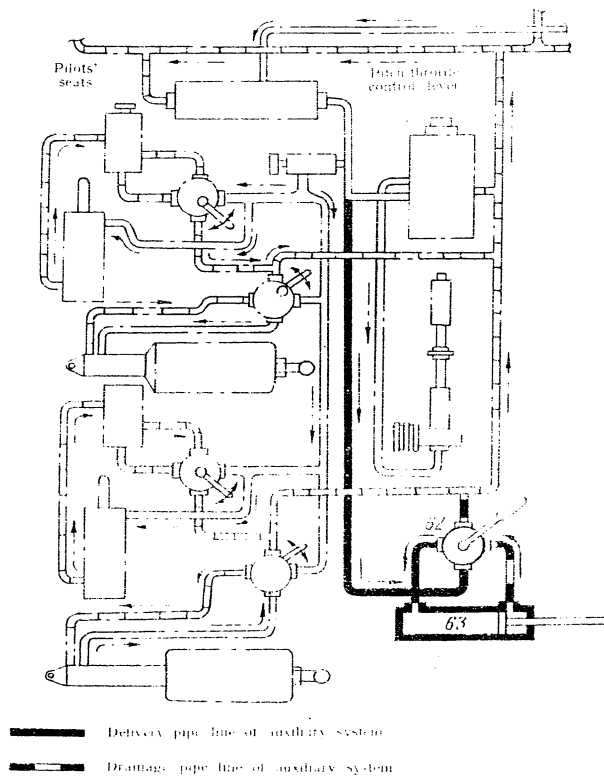


Fig. 34. Connection of Hydraulic Unit of Ventral Container Door Panels Control to Helicopter Auxiliary Hydraulic System. Diagram

62 - door panels control cock, 63 - hydraulic cylinder with ball lock.

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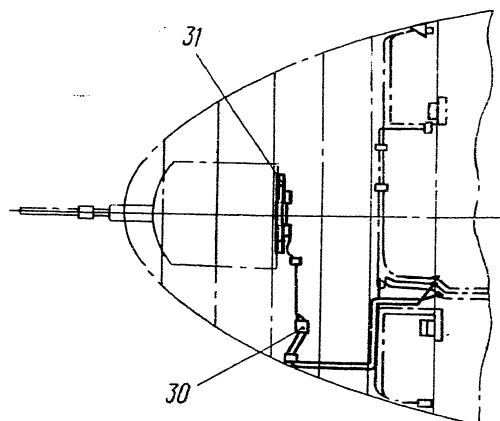
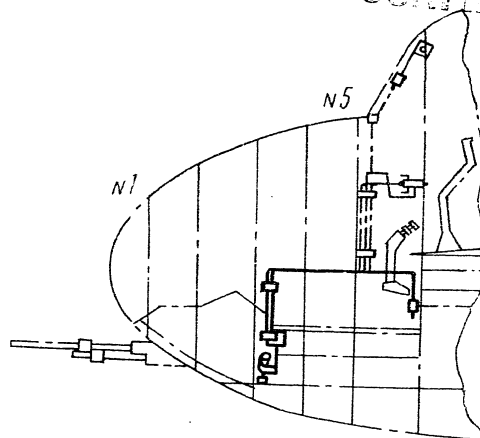


Fig. 45. Layout of Hydraulic Units of Ventral Container Door Panels on Helicopter

30 -- door panels control cock; 31 -- hydraulic cylinder with ball lock.

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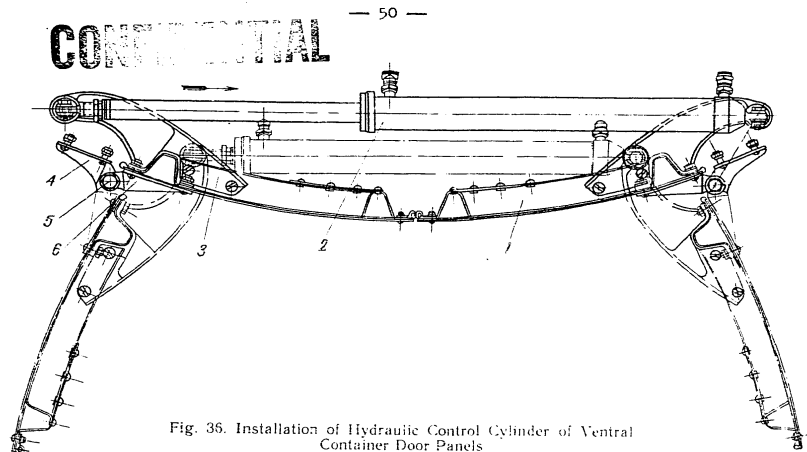


Fig. 36. Installation of Hydraulic Control Cylinder of Ventral Container Door Panels

1 — door panel; 2 — hydraulic cylinder with ball lock; 3 — door panel lever; 4 — hinge on fuselage; 5 — axle bolt; 6 — hinged bracket on door panel.

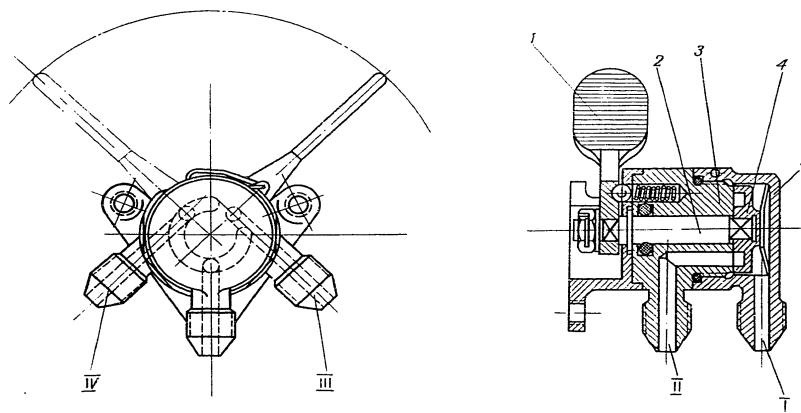


Fig. 37. Door Panels Control Cock

1 — handle; 2 — pin; 3 — body; 4 — slide valve; 5 — cap; I — pipe connection of delivery pipe line; II — pipe connection of drainage pipe line; III and IV — pipe connections of door panels control cylinder pipe line.

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they are all connected with the drainage line. By turning handle 1 from the middle position to the right or to the left pipe connections III and IV are connected respectively with the delivery or drainage pipe line, which corresponds to the closed or opened position of the door panels.

Hydraulic Cylinder with Ball Lock

The hydraulic cylinder (See Fig.38) consists of cylinder 3 with welded on ear lug, piston 5, rod 2, box 8, sleeve 4, spring 6 and balls 7.

As indicated in Fig.38, rod 2 cannot be affected by outside load applied to ear lug 1 because the balls are placed in the recess of rod 2 and cannot disengage from it as they thrust against the surface of box 8 and sleeve 4.

As liquid is delivered under pressure to pipe connection 1 the lock opens. The liquid shifts sleeve 4, compresses spring 6 and releases balls 7 from the recess. When the balls disengage the recess of rod 2, piston 5 starts travelling all the way to the right. If liquid is delivered to pipe connection II, the piston travels in the opposite direction.

The operation of the lock is as follows: when sleeve 4 contacts balls 7 and the piston is still moving, spring 6 begins to compress until the recess on rod 2 comes in line with the axis of balls 7, then the spring will shift sleeve 4 so that it bears against rod 2 thus locking the balls in the recess.

2. Inert Gas System

To prevent an explosion when the main fuel tanks are hit by splinters, bullets or shells provision is made on the helicopter for the inert gas system. This system precludes the appearance of a dangerous mixture of kerosene vapours and oxygen of the ambient air in the fuel tanks as the fuel level is reduced during the operation of the engines.

The inert gas used in the system is carbon dioxide (CO₂) contained in three 8-litre bottles 10 which are installed over the ceiling of the cargo compartment between frames Nos 27 and 28 (Figs 40 and 41).

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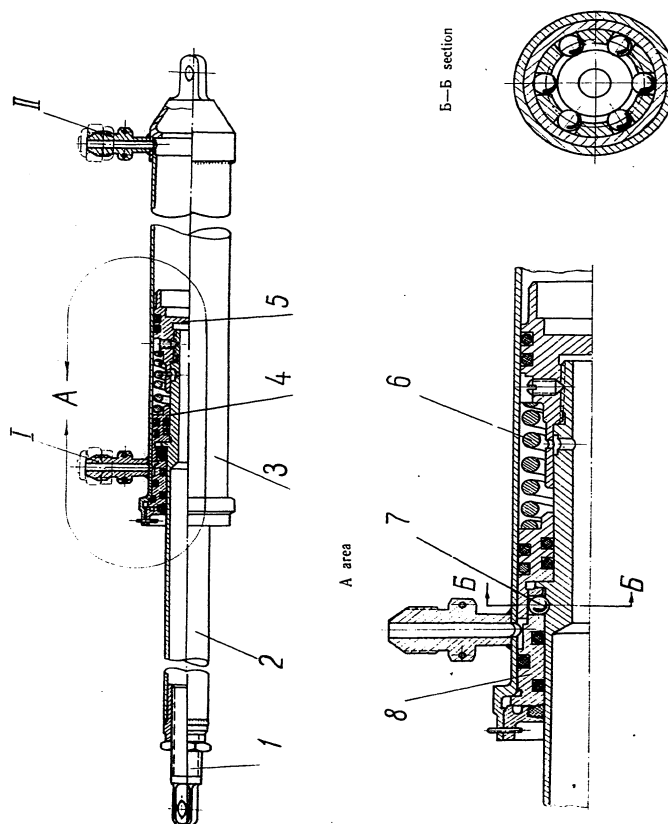


Fig. 38. Hydraulic Cylinder with Ball Lock
 1 — ear lug; 2 — rod; 3 — cylinder; 4 — sleeve; 5 — piston; 6 — spring; 7 — ball; 8 — box; 1, 11 — pipe connections of control cock pipe line.

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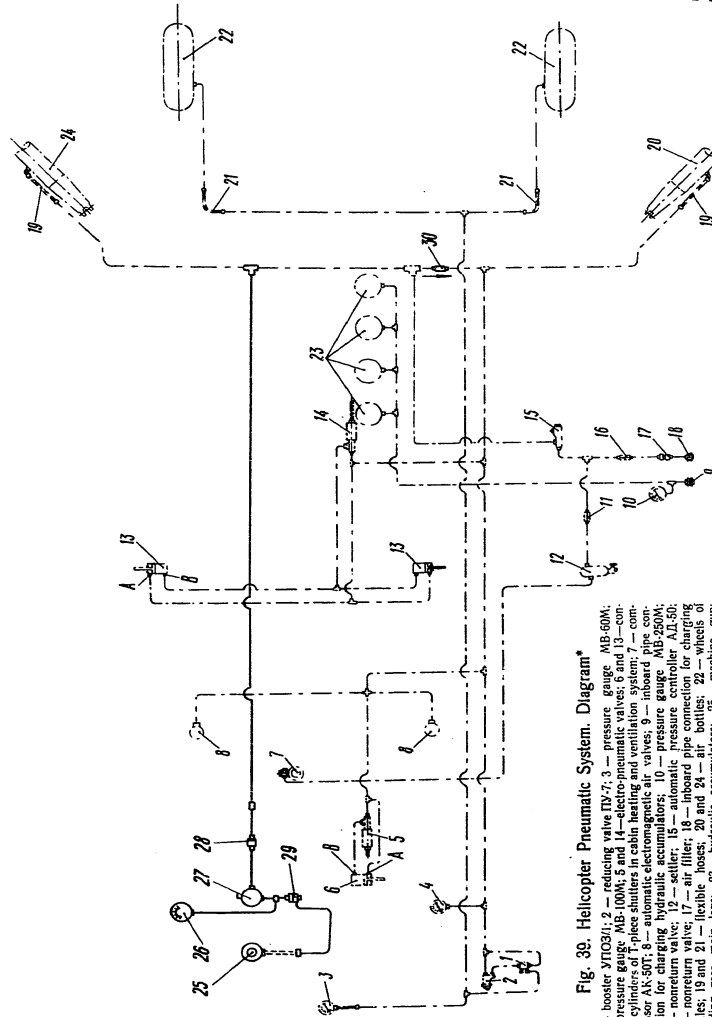
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Fig. 39. Helicopter Pneumatic System. Diagram*

1 — booster pump; 2 — pressure gauge MB-60M; 3 — pressure gauge MB-60M; 4 — pressure gauge MB-60M; 5 — pressure gauge MB-60M; 6 — pressure gauge MB-60M; 7 — control cylinder; 8 — automatic electromagnetic air valves; 9 — inboard pipe connection for charging hydraulic accumulators; 10 — pressure gauge MB-250M; 11 — nonreturn valve; 12 — air filler; 13 — automatic pressure controller AJI-50; 14 — nonreturn valve; 15 — air filler; 16 — automatic pressure controller AJI-50; 17 — nonreturn valve; 18 — air filler; 19 — automatic pressure controller AJI-50; 20 — pressure gauge MB-100M; 21 — additional air bottle (machine gun mount cradle); 22 and 30 — nonreturn valves; 23 — electropneumatic valve 2K-48; 24 — machine gun; 25 — pressure gauge MB-100M; 26 — machine gun; 27 — machine gun; 28 — machine gun; 29 — machine gun; 31 — machine gun; 32 — machine gun; 33 — machine gun; 34 — machine gun; 35 — machine gun; 36 — machine gun; 37 — machine gun; 38 — machine gun; 39 — machine gun; 40 — machine gun; 41 — machine gun; 42 — machine gun; 43 — machine gun; 44 — machine gun; 45 — machine gun; 46 — machine gun; 47 — machine gun; 48 — machine gun; 49 — machine gun; 50 — machine gun; 51 — machine gun; 52 — machine gun; 53 — machine gun; 54 — machine gun; 55 — machine gun; 56 — machine gun; 57 — machine gun; 58 — machine gun; 59 — machine gun; 60 — machine gun; 61 — machine gun; 62 — machine gun; 63 — machine gun; 64 — machine gun; 65 — machine gun; 66 — machine gun; 67 — machine gun; 68 — machine gun; 69 — machine gun; 70 — machine gun; 71 — machine gun; 72 — machine gun; 73 — machine gun; 74 — machine gun; 75 — machine gun; 76 — machine gun; 77 — machine gun; 78 — machine gun; 79 — machine gun; 80 — machine gun; 81 — machine gun; 82 — machine gun; 83 — machine gun; 84 — machine gun; 85 — machine gun; 86 — machine gun; 87 — machine gun; 88 — machine gun; 89 — machine gun; 90 — machine gun; 91 — machine gun; 92 — machine gun; 93 — machine gun; 94 — machine gun; 95 — machine gun; 96 — machine gun; 97 — machine gun; 98 — machine gun; 99 — machine gun; 100 — machine gun.

* The bold line indicates the machine gun recharging system.

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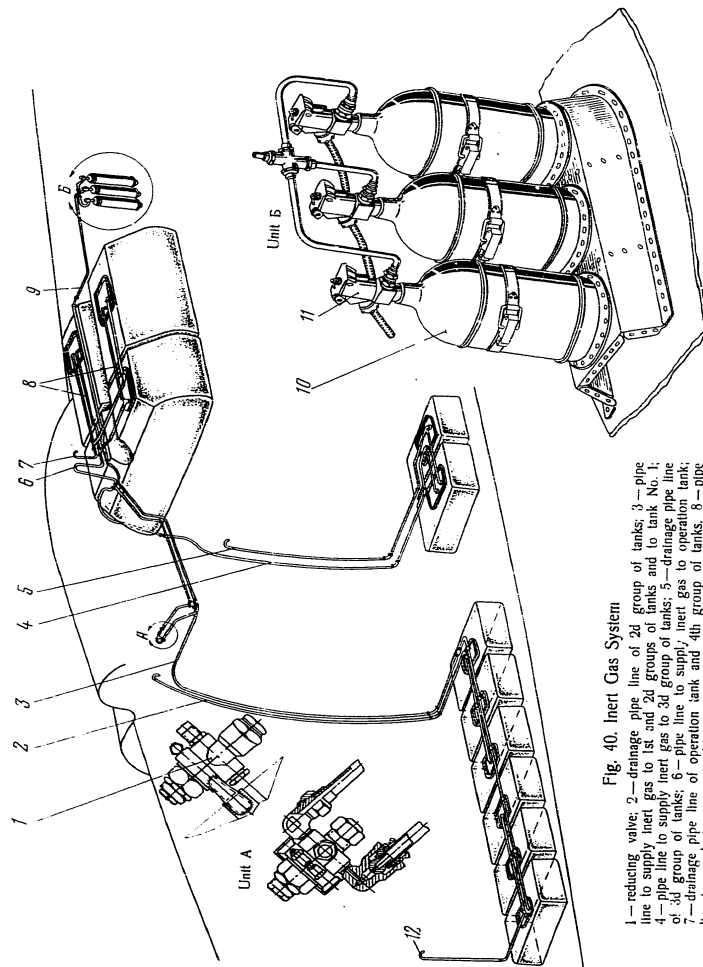


Fig. 40. Inert Gas System

1 — reducing valve; 2 — drainage pipe line of 2d group of tanks; 3 — pipe line to supply inert gas to 1st and 2d groups of tanks and to tank No. 1; 4 — pipe line to supply inert gas to 3d group of tanks; 5 — drainage pipe line of 3d group of tanks; 6 — pipe line to supply inert gas to operation tank; 7 — drainage pipe line of operation tank and 4th group of tanks; 8 — pipe line to supply inert gas to 4th group of tanks; 9 — pipe line for delivering inert gas from tanks to system; 10 — inert gas bottle; 11 — inert gas lock with pyrotechnic starter; 12 — drainage pipe line of 1st group of tanks.

Note. Unit A is shown in two projections.

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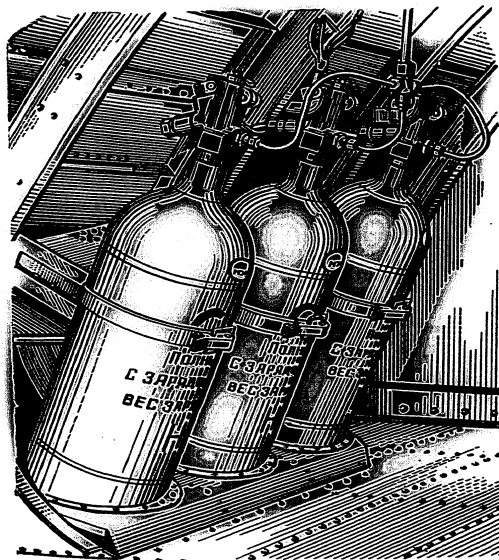


Fig. 41. View of inert gas bottles installed between fuselage frames No. 27 and No. 29

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The bottles (OCY5) are filled with liquefied dehydrated carbon dioxide, 5.7 kg in each, and are provided with a lock and pyrotechnic starter 11 with a remote control. Gaseous carbon dioxide flows by the pipe lines to reduction unit 1 (PB-50M) and then it passes at a reduced pressure into the metering calibrated jet, from which it goes further at an excess pressure of 0.15 kg/sq.cm to the upper parts of fuel tanks filling the vacant space.

To protect the reduction unit with the metering jet from freezing they are installed on the brace of the main gear box frame in a zone of higher temperature resulting from the heat of the engine exhaust pipe.

The inert gas system is switched on by the switch located on the left-hand panel of the flight engineer.

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Chapter Three

HELICOPTER ARMOUR PLATING

Description and Maintenance Instructions

The Mx-6 helicopter is provided with armour plating to protect the pilots and navigator from enemy ground small arms fire. Armour protection is made of twelve detachable steel plates.

The following armour plates are installed on the helicopter to ensure the protection of the crew:

1. Four armour plates are placed on the floor of the pilots' cabin near the brackets of the control stick and foot control pedal (Fig.42).
2. One armour plate is installed on the panel in front of frame No.6 to protect the pilot on the right from frontal fire (Fig.43). (The left pilot is protected by the equipment in the navigator's cabin).
3. One armour plate is fastened on the outside of the navigator's cabin door (Fig.44).
4. Two armour plates are secured on frame No.9 immediately behind the backs of the pilots' seats (Fig.45).
5. Two armour plates are fixed on the outer surface of the pilots' doors (Fig.44).
6. Two armour plates are installed outside on both sides between frames Nos 1 and 2 (Fig.44) and cover the lower side windows of the navigator's cabin.

The armour plates are secured with bolts and retaining nuts.

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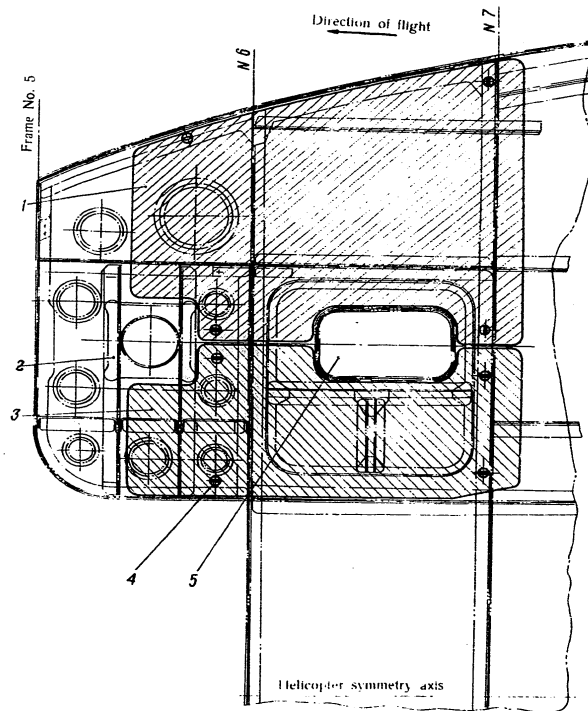


Fig. 42. Arrangement of Armour Plates on Floor of Pilots' Cabin
 1 and 3 - armour plates; 2 - foot control pedal bracket; 4 - bolt for fastening
 armour plate; 5 - recess for control column.

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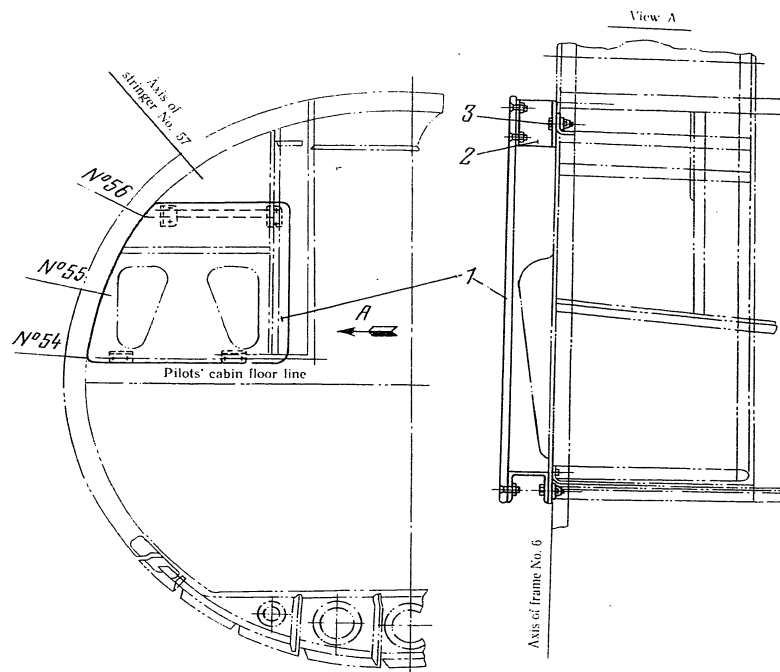
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Fig. 43. Installation of Armour Plate before Frame No. 6

1 - armour plate; 2 - intermediate bracket; 3 - fastening bolt

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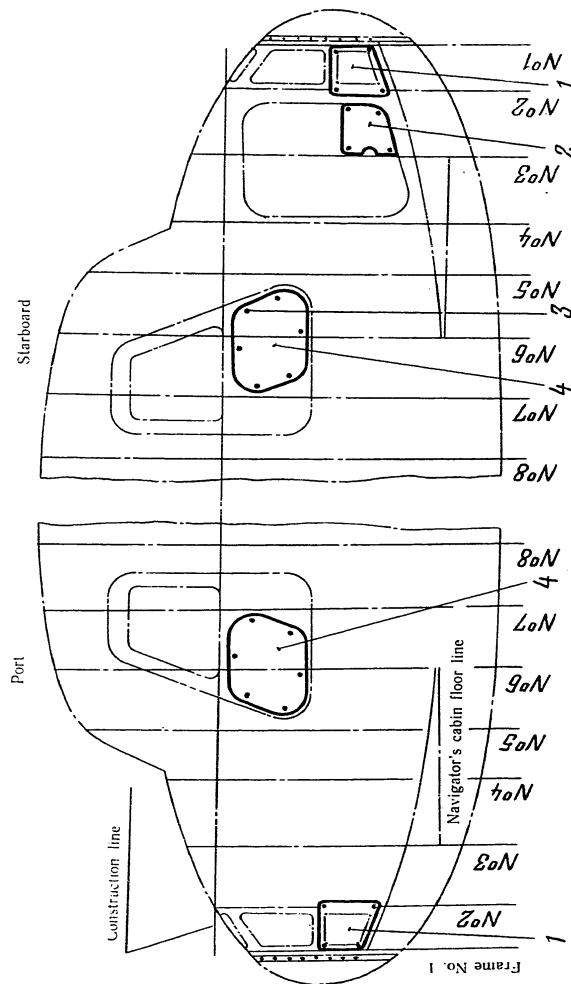


Fig. 44. Outside Arrangement of Armour Plates on Walls of Navigator's and Pilots' Cabins
 1 — armour plate; 2 — armour plate on navigator's cabin door; 3 — armour plate fastening bolt; 4 — armour plates on doors of pilots' cabin.

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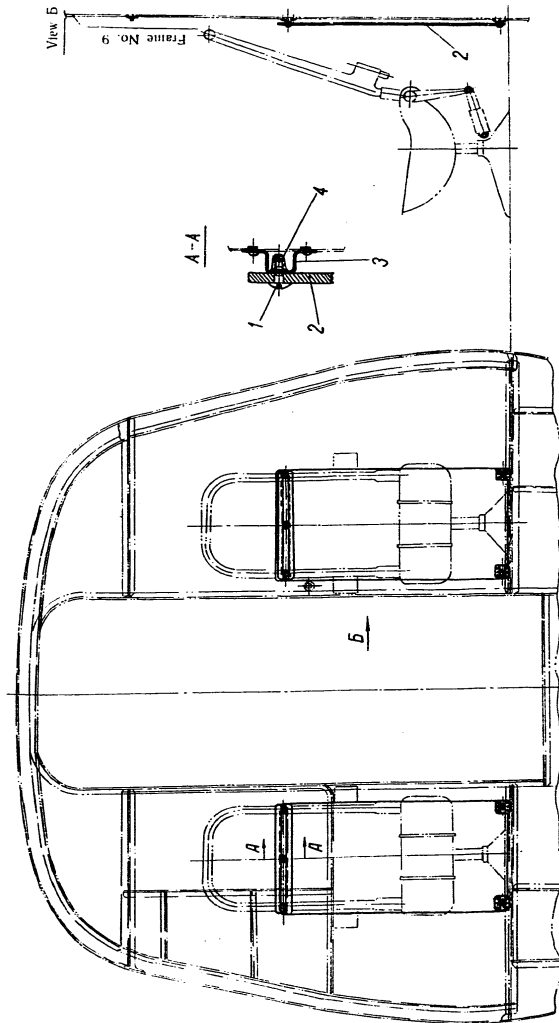
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Fig. 45. Arrangement of Armour Plates behind Pilots' Seats (looking in the direction of flight at frame No. 9)

1—fastening bolt; 2—armour plate; 3—bracket; 4—retainer nut.

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W A R N I N G !

The weight of armour plates mentioned in Items 1, 2 and 3 is included into the construction weight and in view of the helicopter centering requirements the armour plates must not be removed. The other armour plates which make up a single set furnished with the helicopter are installed only in case of necessity and their weight is included into the weight of the carried cargo. Therefore, in determining the general centre of gravity of the carried cargo it is necessary to take into consideration additional armour plates with a weight of 94 kg each and the arm from the main rotor axis equalling 8.95 m. This should be borne in mind to ensure proper arrangement of the cargo in accordance with the marks on the right wall of the cargo compartment.

After installation the armour plates it is necessary to compensate compasses.

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Chapter Four
HVB-1M MOUNT
OPERATING INSTRUCTIONS
I. HANDLING MACHINE GUN ARMAMENT AFTER
HELICOPTER IS RECEIVED BY UNIT

1. General Information

When the helicopter is received by the unit, the helicopter armament is inspected and checked for sound condition, good repair and completing with tools.

The results of the helicopter armament inspection are entered in the corresponding Log Books.

The results of checking the armament for condition and completing as well as a list of troubles detected during the inspection are entered in the inspection record.

The armament is inspected and prepared for operation by an armament mechanic or technician in the sequence corresponding to the procedure given in the Instructions.

2. Preparing Machine Gun Mount for Inspection

After the machine gun mount is checked for completeness prepare it for the first inspection observing the following procedure:

1. Open the HVB-1M door panels using a special control cock arranged in the cabin under the navigator's rack.
2. Make sure that the machine gun is unloaded, there is no cartridge in the chamber and the switches are cut off.

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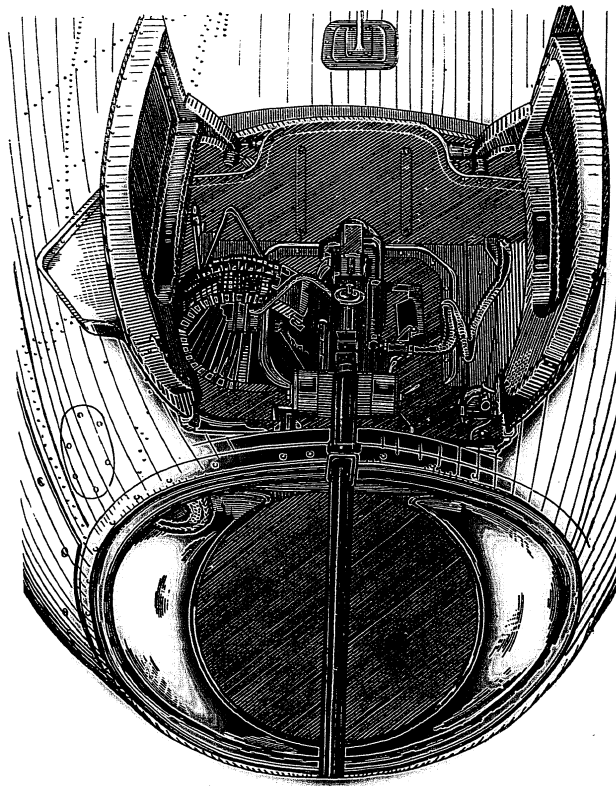


Fig. 46. Arrangement of HYB-1M Mount on Helicopter
(bottom view, door panels open)

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The MACHINE GUN(MVJEMET) and the AUXILIARY (BCHOMOPAT.) switches are located on the control panel instrument board

3. To inspect the rear portion of the machine gun mount, remove the rear cover of the shroud in the cabin.

3. Removing Machine Gun from Mount

W A R N I N G :

When handling the machine gun mount, take care not to jam the electric bunched conductors for it will result in breaking the wires in the places of soldering and short-circuiting. In most cases, the wires are broken by a careless handling of bunched conductors.

Remove the machine gun in the following sequence:

1. Using a wrench undo the coupling nut and disconnect the flexible chute from the machine gun pneumatic cylinder (Fig.47).
2. Using the MIP plug connector wrench (See Fig.61, Appendix No.1) disconnect the bunched conductor with the MIP plug connector main portion from the electric release bunched conductor with the mating part of the MIP plug connector (Fig.48).
3. Having depressed the machine gun cover locks by hand, turn the cover and having pulled the latch locking the gun receiver feed opening assembly, remove the feed opening assembly together with the flexible chute (Fig.49). Close the machine gun receiver.
4. Using special socket wrench 2 (Fig.61) turn the right- and left-hand nuts through 180° and open the front attachment fitting (Fig.50) from the LOCKED (3AKPHTO) position to the OPEN (OTKPHTO) position in compliance with the inscription on these parts.
5. Move the machine gun backwards till it leaves the front and rear attachment fitting grooves keeping the machine gun from falling.

4. Inspection of Machine Gun Mount

After the machine gun has been removed inspect the mount to see that the units and parts are free from cracks and other

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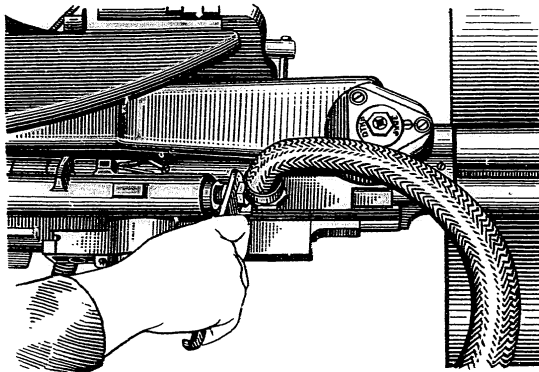


Fig. 47. Undo Coupling Nut and Disconnect Flexible Chute from Machine Pneumatic Cylinder

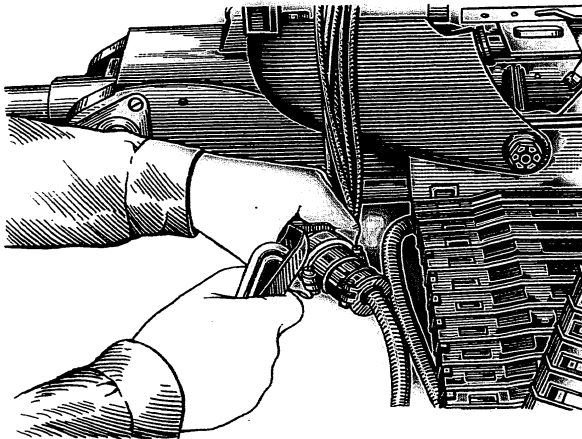


Fig. 48. Disengage Bunched Conductor with Main Portion of Plug Connector from Electric Trigger Bunched Conductor with Mating Part of Plug Connector

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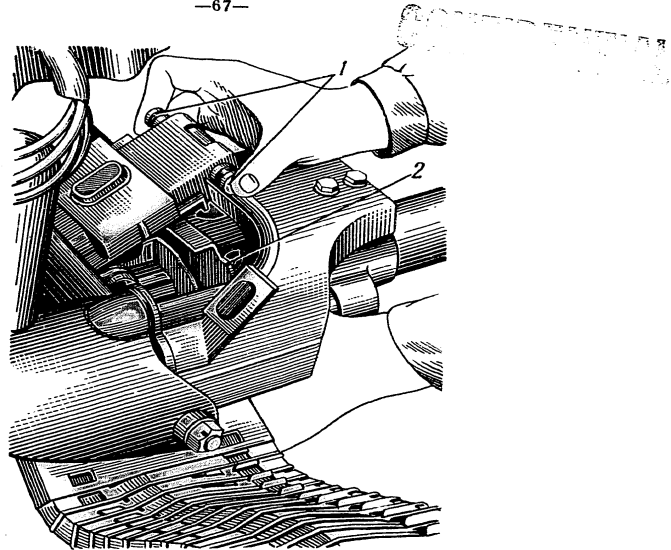


Fig. 49. Press Fasteners 1 of Machine Gun Cover, Turn it, Depress Out Latch 2 and Remove Feed Opening Assembly together with Flexible Chute

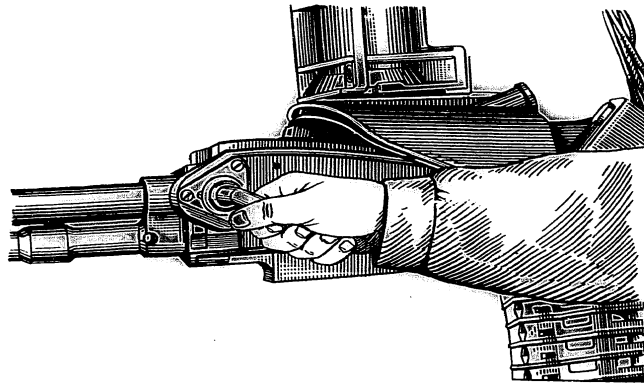


Fig. 50. Using Socket Wrench Turn Right- and Left-Hand Nuts of Front Attachment Fitting through 180°

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mechanical damage, check to see that the individual units are intact and properly locked and, examine corrosion-preventive coatings on all the parts, especially on parts made of magnesium alloy, for condition.

Before inspecting the machine gun mount, completely remove lubricant from it and clean it with a dry cloth to remove dust and dirt. Inspect the mount in the following sequence:

1. Visually inspect all the accessible units and parts, check the condition of the machine gun cradle, machine gun front and rear attachment fittings, yoke, bracket, controls, K10-T collimator sight, limit stops, ammunition box, flexible chute, rigid chute, case ejection chute and other units of the machine gun mount.

2. Check all the attachment points for presence of screws, nuts, cotter pins and pins, check the cradle-to-yoke attachment half-axles for proper locking. Using wrenches check the machine gun-to-cradle rear attachment fitting bolts for tightening and tighten them if necessary; check the cradle-to-controls rod lug bolts on the cradle for security of tightening; check the machine gun mount-to-helicopter cradle attachment bolts for security of tightening.

- 2a. Visually inspect the K10-T collimator sight to make sure that the reflector, hinged light filter and lenses are free from cracks and chips and the electric light is serviceable. Besides, check the collimator stand-by sight for presence of luminous material.

If the reflector and light filter are defective, replace them with spare ones furnished with the collimator sight set. If the lenses are faulty, replace the collimator; to do this, unlock the adjustment bolts and drift the pins locking the sight clamp screws. Unscrew the pins from the bracket and remove the collimator together with the clamp.

WARNING!

Balls, liable to be lost, are placed in the clamp holes. Bring the clamp ends apart and release the defective collimator.

Install a new collimator after drilling its neck.

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Install the new collimator reversing the removal procedure and then adjust it.

Make an entry in the Log Book about the replacement performed.

3. Check the stowed position limit switch for proper functioning; to do this unlock the controls by turning the thumb-piece through 180° and, pushing the control grips in the vertical plane, release the limit switch button. A sluggish click indicates that the limit switch is defective and must be replaced. Besides, check the limit switch functioning by a warning light on the test panel; for this purpose energize the machine gun mount and turn it in the vertical plane. The warning light is on with the machine gun barrel down.

4. Visually inspect the pneumatic system hoses and pipes for damage.

5. Check the electric cable hoses and make sure that their braiding is free from damage. Check that the 3K-48 electro-pneumatic valve plug connector nut is properly tightened.

6. Inspect the ammunition feed chutes. If any deformations or projections obstructing the ammunition belt motion are found, eliminate them. Inspect the chute in the cabin-to-ventral container joint and make sure that it is serviceable.

To examine the feed line remove upper cover 2 (Fig. 13) from the HVB-1M jacket and remove jacket 8 (Figs 13 and 14) from the DZUS fasteners.

Inspect the flexible chute-to-rigid chute joint. If it is defective, remedy the trouble.

Note. If necessary, the number of the flexible chute links may be increased or replaced.

7. Make sure that the roller rotates smoothly without sticking in the ammunition box.

8. Tighten the nuts of the pneumatic system pipe connections.

9. After the inspection of the machine gun mount is over, apply a light coating of the LIATM-201 anti-freezing lubricant.

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cant to the following elements: rear gun attachment fitting guide rails, front machine gun attachment fitting seats, rigid chute and ammunition feed opening working surface, and also all the blued and phosphate parts and units in the places accessible for lubricating and cleaning.

10. Inspect the helicopter structural elements to which the machine gun mount is attached and make sure that they are in good condition.

11. In case of damage to corrosion-preventive coatings on the parts made of magnesium alloy, restore the coatings in conformity with the Instructions for preventing and eliminating corrosion of the armament "electron" units of the HVB-1M mount during the operation (Appendix 2).

If no heated hangars are available, use special devices to create the temperatures indicated in the Instructions.

12. Check the bolts attaching the rigid chute to helicopter frame 1 for tightening. Remove the loose attachment bolts, make sure that they and the nuts are serviceable; after that reinstall the bolts in place and tighten the nuts.

13. Check the ammunition box-to-rigid chute joint. Remove the belt motion obstructing projections along the perimeter of the feed opening, as well as deformations of the ammunition box and cover.

14. Check the charging and intercom set and KLO-T electric light rheostat buttons for proper operation. Besides, check by a click the firing buttons mounted in the control grips for actuation. A sluggish click indicates that it is necessary to check the buttons as specified in Item 8, Para 6, Section I and replace them, if necessary, as outlined in Item 1, Para 2, Section VIII.

5. Installation of Machine Gun on Mount

1. Before installing the machine gun on the mount clean, completely assemble the machine gun and secure the case ejection chute on it.

To do this, remove the pin from the machine gun, put the case ejection chute on the machine gun lower guides and insert the pin in place.

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2. When preparing the machine gun mount for a flight at low outboard air temperatures, strictly follow the Operating Instructions furnished with the A-12,7 machine gun.

3. Install the machine gun by inserting forward the machine gun trunnions in the cradle front attachment fitting nut sockets and the rear guide lugs - in the rear attachment fitting guides until the trunnions enter the front attachment fitting nut sockets.

Note. Before installing the machine gun first clean the front and rear attachment fitting slots with a clean dry cloth and then apply a light coating of anti-freezing lubricant to them. Remove the plug covering the opening under the machine gun from the door panels.

Then using a socket wrench turn the front attachment fitting nuts through 180° to lock the machine gun on the cradle.

The cradle must be in the horizontal position to facilitate the machine gun installation.

4. After the machine gun has been installed, check its position on the mount taking into account the fact that the clearances between the machine gun body and all the mount parts (except for the machine gun attachment points) should be not less than 1.5 mm. A clearance between the recoil mechanisms and cradle is permitted to be not less than 0.5 mm.

5. Having turned the machine gun receiver cover, mount quick-release feed opening assembly rigidly attached to the flexible chute on the machine gun receiver, latch the feed opening assembly (Fig.49) and close the machine gun receiver cover.

Note. When mounting the feed opening assembly together with the flexible chute on the machine gun check to see that the safety pin locking the recoil mechanism shaft does not hinder installing the feed opening assembly.

6. Joint the pneumatic system hose to the pipe connection by the coupling nut.

7. Connect the firing solenoid plug connector, fully tighten up the coupling nut right home.

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6. Checking Machine Gun Mount Functioning

General Instructions

1. Checking the machine gun mount functioning is confined to observing the operation of all its units when performing checking operations or making simple measurements.

2. During the check operations performed on the ground use only a 27 V D C external power supply source and a voltage regulator maintaining a level of 27 V in the helicopter electrical system input (but not in the generator output).

Checking Ammunition Feed System

W A R N I N G !

Check the operation of the ammunition feed system using only blank non-deformed cartridges.

3. Before loading the machine gun inspect the ammunition feed lines and check that they are free from projections obstructing the cartridge belt motion.

4. By pulling the ammunition belt through, make sure that it easily moves through the chutes and openings at any turn of the cartridges and links relative to their own axes (for this purpose use a belt containing complete ammunition allowance of blank cartridges).

5. The ammunition belt should easily and without jammings move through the whole feed line including an ammunition box, rigid chute and a flexible chute.

Projections obstructing the ammunition belt motion are not allowed. The feed line should ensure faultless charging of the A-12,7 machine gun in all positions indicated by the HYB-1M mount. Measure the effort for pulling the ammunition belt by using the dynamometer; the effort should not exceed 25 kg.

Checking Firing and Charge Circuits

W A R N I N G !

Perform the check with the machine gun discharged.

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6. Using the valve open the door panels and see that the pilot lamp comes on. Simultaneously check to see that the stowed position lamp is on.

7. Cut in the controls instrument board switches labelled "AUXILIARY" and "MACHINE GUN" and depress the button labelled "CHARGE" on the controls upper cover. The 3K-48 electro-pneumatic valve should actuate and charge the machine gun.

In this case the lamp indicating that the machine gun is ready to fire should blink and the YCE-1 counter will read one division less.

8. Press one of the buttons mounted in the control grips. The firing solenoid should become actuated. Then recharge the machine gun and repeat all the operations mentioned above using the second button.

7. Checking the Boresighting

After all the operations specified in this Instruction have been accomplished, proceed to checking the machine gun boresighting.

Checking the boresighting consists in performing all the operations described in detail below in Section V.

II. OPERATING MACHINE GUN MOUNT ON GROUND AND IN FLIGHT

A. PRE - FLIGHT OPERATIONS AND CHECKS

1. Preparing Machine Gun Mount for Inspection and System Inspection

1. Prepare the machine gun mount for inspection following the Instructions outlined in Items 1 - 3, Para 2, Section I.

2. If the machine gun has been lubricated for extended storage, do the following:

(a) remove the machine gun from the mount following the Instructions specified in Para 3, Section I;

(b) clean and lubricate the machine gun with operating lubricant as outlined in the Machine Gun Operating Instructions;

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(c) install the machine gun on the mount as specified in the Instructions, Para 5, Section I.

3. Check the operation of the machine gun mount as outlined in Para 6, Section I.

4. Before a flight check the firing and charge circuits as specified in Items 7 and 8, Para 6, Section I.

2. Loading the Ammunition Box and Charging

Machine Gun

1. (a) Remove jacket 8 (Figs 13 and 14) covering the joint of the rigid chute;

(b) remove the rear section of the rigid chute;

(c) take out the cotter pin fixing the ammunition box in the guides;

(d) move forward the ammunition box along the guides and place the box for charging on the special stand.

2. Open the box cover, lay the ammunition belt into the ammunition box as indicated on the stencil and install the box and the rigid chute. Put the ammunition belt in the ammunition box in compliance with the diagram (Fig.52) and in the Instructions written on the walls of the box. Put the ammunition belt in horizontal rows providing clearance A equalling 20 - 25 mm between the ammunition box cover and the upper row of the ammunition belt to ensure a free motion of the belt.

W A R N I N G !

When loading the ammunition box put all the rows of the ammunition belt closely and uniformly preventing the cartridges from bunching and the belt from bending especially at the box side walls where the ammunition belt changes its direction. A cartridge should be inserted in the last link of the belt.

3. Drag the end of the upper row of the ammunition belt into the rigid chute over the roller and through the box opening and then pull the belt through the rigid and flexible chutes to the machine gun receiver.

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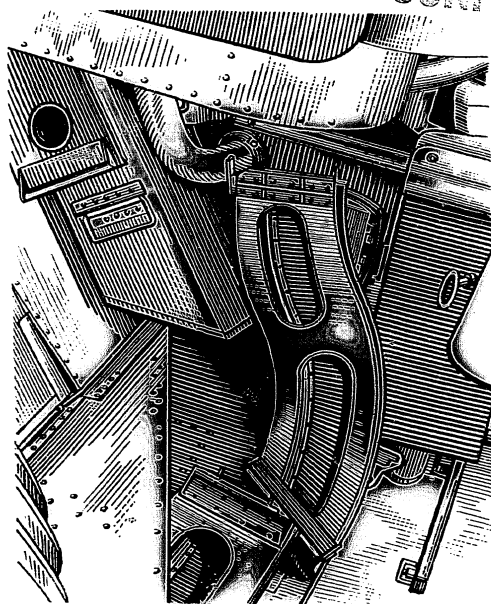


Fig. 51. Removing Shaped Panel and Rigid Chute for Loading Ammunition

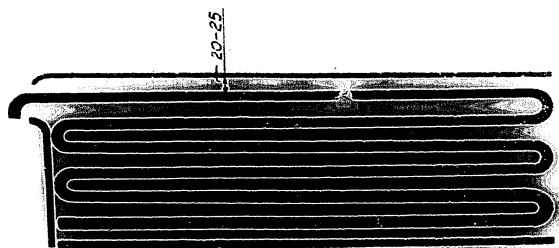


Fig. 52. Diagram of Laying Ammunition Belt in Ammunition Box

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At the starting movement of the ammunition belt through the rigid chute it should be slightly pulled back and then feed the belt forward to a large extent. Such a pulling of the belt precludes the ammunition belt from getting jammed in the bends of the rigid chute.

4. Turn the machine gun receiver cover and insert the ammunition belt in it when the belt approaches the receiver; to do this, using an ammunition belt pulling cable hook (Fig.61) catch the link of the first cartridge (Fig.53) of the belt and pull the latter into the machine gun receiver. Then disengage the belt pulling cable hook and close the machine gun receiver. Arrange the cover on the ammunition box.

3. Preparing Machine Gun for Firing

WARNING!

With the machine gun loaded, NEVER close the MACHINE GUN switch of the controls or press the firing buttons of the control grips.

To prepare the machine gun for firing do the following:

- (a) cut in the switch labelled AUXILIARY on the controls;
- (b) press the charging button, permitting the compressed air to depress the machine gun moving parts to the extreme rear position; from this position the moving parts will be moved forward by the return spring and send a cartridge into the chamber. In this case, the control board lamp in the YCB-1 counter indicating that the gun is ready for firing will come on.

The ready-to-fire light is off if the moving parts of the gun are in an intermediate position, due to a stoppage in fire or the lamp is defective.

Note. When charging the machine gun follow the "A-12,7 Gun Operating Instructions".

B. IN - FLIGHT OPERATION

Open the HYB-1M mount door panels. Remove the case from the collimator sight and wipe the optics with a soft filter cloth furnished with the collimator sight. Be sure that the

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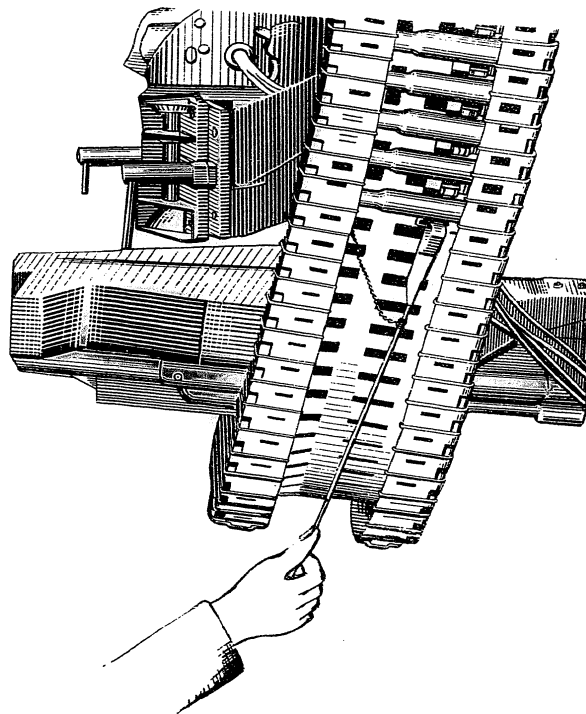


Fig. 53. Catch Ammunition Belt First Cartridge Link by Pulling Cable Hook

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ready-to-fire lamp is on. If the lamp is off, charge the gun pneumatically.

Unlock the machine gun mount by turning the thumb-piece of the controls through 180° clockwise till a click is heard.

Close the MACHINE GUN switch. The machine gun mount is ready for flight.

W A R N I N G !

NEVER hang gas-masks, telephones, map cases and other things on the reflector and light filter of the collimator sight.

**C. SEQUENCE OF OPERATIONS
PERFORMED WITH SIGHT**

When a target appears, the gunner must estimate visually the target size, velocity and the aspect angle for determining the required lead.

At a predicted firing the sight reticle circle is brought to the target so that the target moves towards the reticle centre.

The K10-T sight reticle has two prediction circles - larger and smaller and cross lines with range finding divisions in mils. The larger division value is 20 mils while the smaller one is 10 mils.

A range to the target is determined by the target angular value on the reticle. The target size known to the machine gunner beforehand may be taken as a base.

P r o b l e m:

If a target is 7.5-m long and covers two small divisions of the reticle (20 mils), the range to the target in this case will be equal to the base divided by the target angular value expressed in mils:

$$R = \frac{7.5 \cdot 1000}{20} = 375 \text{ metres.}$$

The target speed is estimated by eye. When firing at ground targets, $V_t = 35 \text{ km/hr}$ corresponds to one small range finding division (equal to 10 mils) at a range to a target of 400 m, and $V_t = 70 \text{ km/hr}$ corresponds to one large division (equal to 20 mils) for a range of 200 m:

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10 mils - 37.2 km/hr;
 20 mils - 74.4 km/hr.

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When firing at the enemy infantry it is advisable to fire without prediction, aiming via the sight reticle cross-hairs.

When firing at targets moving at a speed of $V_t = 35 - 37$ km/hr aim at them with a prediction of one small division and for $V_t = 70 - 75$ km/hr - with a prediction of one large division.

III. AFTER-FLIGHT OPERATION AND CHECK

WARNING!

Proceeding to the post-flight inspection of the machine gun mount bear in mind that if the machine gun has been fired during the flight a stoppage might occur. As a result of this the moving parts of the machine gun may be on the sear or in any intermediate position with a live cartridge in the breech-block; in this case handle the machine gun with care not to cause an accidental shot. Therefore, after the helicopter has been landed, unload the gun taking appropriate precautions.

1. Inspection and Unloading of Machine Gun

WARNING!

When inspecting the machine gun it is prohibited to touch the ammunition belt, links and trigger assembly as well as to strike the machine gun until the machine gun is unloaded (i.e. until a cartridge is extracted from the chamber); ignorance of the above precautions may cause a shot.

To prevent an accidental shot, carefully screw the charging handle into the slider through the butt plate for 5 - 10 mm and pull the moving parts of the machine gun back. This done, unload the machine gun. When unloading the machine gun never direct the gun barrel to near-by people, buildings, etc.

1. If the machine gun ammunition allowance is completely fired in flight, remove the machine gun as outlined in Para 3, Section I, preliminarily extracting cases from the chamber and releasing the moving parts of the machine gun.

Note. When inspecting and unloading the machine gun follow the directions given in the appropriate sections of the "A-12,7 Machine Gun Operating Instructions".

2. If the machine gun mount ammunition allowance has not

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been fired in flight completely or stoppages have occurred which could be removed by recharging (but have not been removed in flight by some reason or other), proceed with the machine gun mount as follows:

Carefully inspect the remaining part of the ammunition allowance and determine the nature and reason of the stoppage.

W A R N I N G !

If a stoppage does not permit to recharge the gun normally by the charging button, screw the charging handle into the slider through the butt plate (the handle is furnished with the machine gun). When the handle nut is screwed on, the slider is pulled back to the extreme rear position. Having depressed the locks, turn the receiver cover, remove the cartridge from the chamber and remedy the stoppage trouble. Unload the machine gun. To do this, unlock the latch, locking the feed opening assembly together with the flexible chute on the receiver, and remove the feed opening assembly. Unscrew the charging handle nut, the moving parts of the machine gun smoothly move to the forward position. Then unscrew the charging handle from the machine gun slider.

3. Press the charging button and check the operation of the machine gun pneumatic system.
4. Using a screwdriver depress sear of the electric trigger and release the firing pin.
5. Remove the machine gun from the mount as indicated in Para 3, Section I, clean and lubricate it as specified in the "A-12,7 Machine Gun Operating Instructions".

2. Unloading Unfired Ammunition

1. Remove the rigid chute, take the ammunition belt out of the ammunition box, disconnect the ammunition belt where it enters the rigid chute.
2. Unlock and move out the ammunition box, then open the box cover and take the remaining ammunition belt out of the box.
3. Remove the remaining ammunition belt from the chutes through the feed opening assembly to which the flexible chute is attached.

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1. Inspect the machine gun mount, wiring and pneumatic system as outlined in Para 4, Section I. Remove dust and dirt from all the mechanisms.
2. Remedy all defects found or send the parts which can not be repaired in place to a unit repair shop.
3. Install the machine gun on the mount following the Instructions outlined in Para 5, Section I.
4. Check the operation of the machine gun mount following the Instructions specified in Para 6, Section I.
5. If the ammunition is not loaded immediately after the inspection, cover the machine gun mount.
If the ammunition is loaded immediately after the inspection of the machine gun mount load the ammunition following the above mentioned Instructions, but do not insert the ammunition belt into the machine gun receiver.
Charge the machine gun just before a flight as outlined in Item 4, Para 2, Section II having performed the pre-flight check.
6. If with the after-flight checks accomplished the helicopter is required for a flight mission, then before this flight perform all the pre-flight operations and checks as specified in Paras 2 and 3, Section II.

**IV. INSPECTING AND CHECKING MACHINE GUN MOUNT WHEN
HELICOPTER IS PARKED FOR EXTENDED PERIOD,
MAINTENANCE OPERATIONS**

1. When the helicopter is parked for an extended period inspect and check the machine gun mount not less than once a month in accordance with the Instructions given in Paras 2, 3, 4, 5, and 6, Section I.
2. After firing 1500 - 2000 rounds, check the play in the ball joints and, if it is detected, tighten joints on the rod and controls. If necessary, replace the locking washers on the rod as indicated below in the Instructions.
3. When operating the mount at least once a month unscrew

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the plug out of opening 5. (Fig.49) of the compressed air bottle for draining condensate with further screwing it in place reliably.

V. MACHINE GUN BORESIGHTING

The machine gun mount boresighting is to properly position the machine gun barrel bore axis relative to the sight line.

The boresighting should be performed after mounting and adjusting the machine gun mount or if the sighting is not accurate or after the machine gun replacement. The boresighting should be checked when the helicopter is received by the unit.

Preparatory Operations

For performing boresighting, set the machine gun axis parallel to the helicopter datum line, using the telescopic azimuth instrument with a levelling vial, the TXII boresighting gauge and other necessary devices.

Installing Target

Boresight machine gun by using the boresighting gauge on target No.1 (Fig.55) with the machine gun in level position.

Target No.1 corresponds to a firing over a range of $D = 400$ m, angle of sight $E = -30^\circ$, range of placing the target $d = 50$ m, flight height $H = 0 - 200$ m, bullet muzzle velocity $V_0 = 810$ m/sec and the bullet ballistic coefficient $C = 1.7$.

Target No.1 is installed in front of the helicopter at a distance of 50 m from the machine gun muzzle.

The target is placed first in horizontal plane then in vertical plane (in height) and adjusted with the aid of the boresighting gauge sight. In this case the sighting line should be directed to the upper cross lines.

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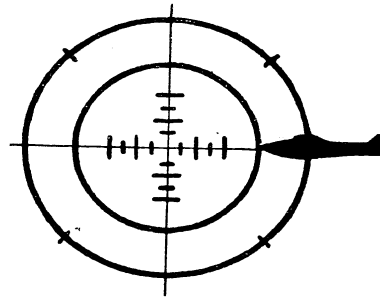


Fig. 54. Sight Reticle

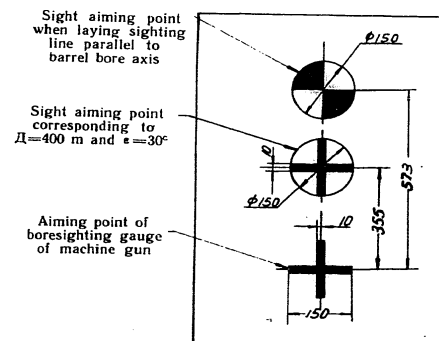


Fig. 55. Testing Target No. 1

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Attach the target to avoid its displacement caused by accidental strikes and wind.

After attaching the testing target, check its setting and make marks on the ground to fix the target position.

The target setting accuracy with respect to the barrel bore axis both in elevation and azimuth should be within $\pm 2.5'$ (using the boresighting gauge).

After the above mentioned operations are performed unscrew the sight clamp hold-down bolt and turning the elevation adjustment screw bring the collimator reticle cross lines to the cross line corresponding to firing over a range of $D = 400$ m and $E = 30^\circ$ (Fig.55).

After that fix the parts by the hold-down bolt and check the sighting accuracy again.

If in the course of locking the sighting line is displaced, unlock the parts and correct the sight setting, with the displacement value and direction taken into account.

Note. In addition, the coarse adjustment by the plugs of the front machine gun attachment fitting on the cradle is permitted. For this purpose unscrew one of the plugs and screw in the other plug, move the machine gun to the direction required. After the adjustment by the plugs is completed, tighten the plugs fully and then immediately loosen one of the plugs $1/2$ or $1/4$ revolution. After that the plugs are locked and the further machine gun adjustment by the plugs is STRICTLY PROHIBITED. The further fine adjustment of the sight is performed by the elevation and azimuth adjustment screws. For adjusting the gunsight use the special pin furnished with the machine gun mount tool kit.

VI. GUN TEST FIRING

After the gun has been boresighted test fire it:

1. at the manufacturing plant;
2. in the military unit if the machine gun is replaced;
3. if boresighting is misadjusted during the helicopter operation.

The boresighted gun is test-fired to check whether the shot holes common point matches the theoretical hit point (within the permissible deviation limits).

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To test fire the machine gun, prepare the following:

1. boresighting gauge;
2. testing target;
3. prepare and load an ammunition belt in the box and insert it into the feed opening assembly (prepare the ammunition belt as follows: ten live cartridges, then one blank cartridge and so on).

Installing Testing Target

1. Install testing target No.2 at a distance of 50 m from the machine gun muzzle face (Fig. 57).
2. Connect the mount in the helicopter mains.
3. Having inserted the boresighting gauge into the machine gun barrel, place the testing target so that the boresighting gauge cross lines accurately match the corresponding mark (bull's-eye) of the testing target.

In this case, in accordance with boresighting, the sighting axis should accurately match the respective bull's eye of the testing target taking into account the lowering of the bullet trajectory on the given range.

Fix the testing target (in a way as in the case of boresighting).

Test Firing in Single Shots (from helicopter)

1. Load the machine gun with five cartridges for firing in single shots, to do this: place a blank cartridge in between the live cartridges, energize the machine gun mount, charge the machine gun to send the live cartridge to the gun barrel. Close the MACHINE GUN switch and align the sight on testing target No. 2.

2. Fire five single rounds, charging the machine gun after each shot. When firing, hold the machine gun mount by the control grips and adjust the sight cross lines on the testing target after each shot.

The mean point of impact is determined by four best shot holes out of five; it should not be outside a circle

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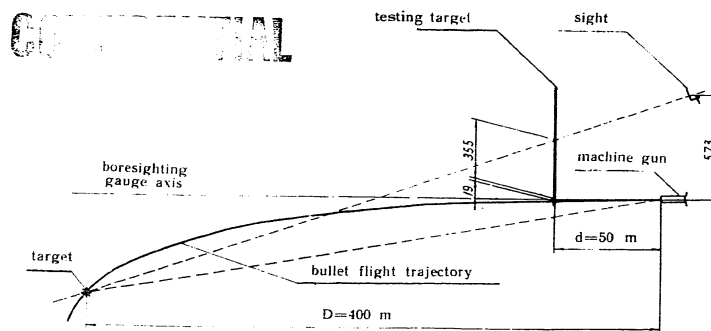
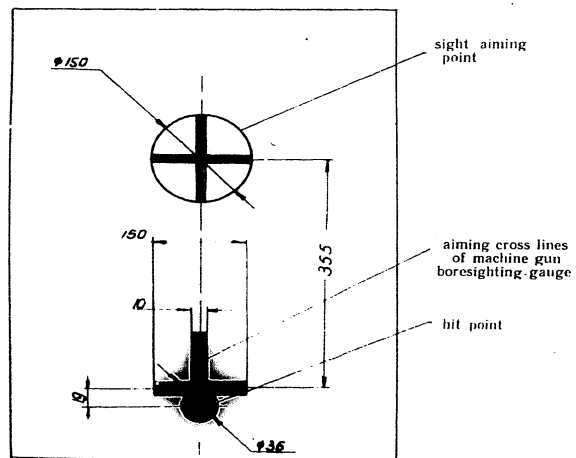


Fig. 56. Boresighting Diagram

Fig. 57. Testing Target No. 2 for HVB-1M Machine Gun Mount
Test Firing at a Distance of 50 m

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having a radius of one mil with the centre in the theoretical hit point of testing target No.2.

3. When checking the sight stability (after flights) do as specified in Item 2; the sight is considered stable, if the mean point of impact of four single shots is not outside a circle having a radius of two mils, with the centre in the theoretical hit point on the target.

Note. If the mean point of impact of four single shots is outside the circle indicated in Item 3 - check for dispersion according to the Section "Firing for Dispersion", if in this case the dispersion parameters meets the requirements outlined in the "Firing for Dispersion" the machine gun mount is considered serviceable.

Test Firing in Bursts

1. Load the machine gun.
2. Energize the machine gun mount and charge the machine gun pneumatically by pressing the CHARGING (ПЕРЕЗАРЯДКА) button.
3. Switch on the firing circuit (close the MACHINE GUN switch on the controls and press the firing buttons on the grips) and test fire the machine gun in two bursts, 10 rounds in each burst, with the machine gun control grips unfixed.

WARNING ! To ensure safety prior to taking the results of each burst of test firing from the testing target move the machine gun movable parts 5 - 10 mm back, using devices for retaining the movable parts in the rear position.

4. Consider each burst separately, note bullet hits (holes) after each burst.

In this case determine the shot holes common point of each burst by the following formulas:

$$X_0 = \frac{\sum X_i}{n} \quad \text{and} \quad Y_0 = \frac{\sum Y_i}{n},$$

where n - number of shot holes,
 X_i and Y_i - shot holes coordinates.

Note. Inadvertent deviation of separate holes of each burst from the common point (not more than one)

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hole per burst) may be excluded from the calculation.

The middle shot holes common point is determined by the following formulas:

$$X_{mcp} = \frac{\sum X_o}{N} \quad \text{and} \quad Y_{mcp} = \frac{\sum Y_o}{N},$$

where N - number of bursts.

The middle shot holes common point deviation from the theoretical hit point should not exceed $X_o = 6$ mils in azimuth and $Y_o = 9$ mils in elevation (at $R = 50$ m).

If the bursts middle shot holes common point is beyond a rectangle measuring 12×18 mils ($X_o = 6$ mils, $Y_o = 9$ mils), the aiming point of the sighting line is changed according to Diagram No.3 (Fig.58) at a distance equal to the deviation of the burst middle shot holes common point in the same direction.

To do this, unscrew the sight clamp hold-down bolts and, turning the elevation and azimuth adjustment screws, align the collimator reticle cross lines with the new sight aiming point indicated in Diagram No.3.

After that lock the sight in the new position by the hold-down bolts and again check for correct aiming.

Next fire a check burst aligning the sight cross-hairs with the sight aiming point.

If the sight locking resulted in displacement of the sighting line, unlock the adjustment and accomplish the aiming, taking into consideration the value and direction of the displacement obtained.

Note. Adjust the sight till its cross-hairs align on the new aiming point of the sight.

W A R N I N G !

Taking all precautions, after every burst check the machine gun for no displacement from the point on which it was aimed by the boresighting gauge. Results obtained by the boresighting gauge should be measured not less than 10 min after the firing is completed.

Seal the hold-down bolts securing the sight adjusting device and paint the places where the bolt ends protrude

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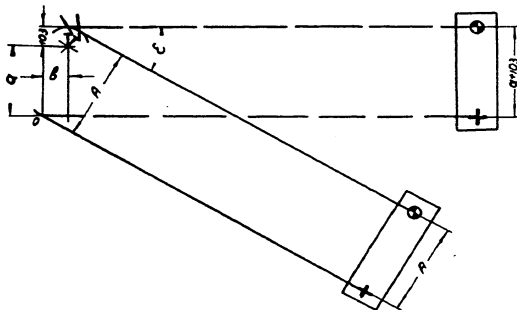
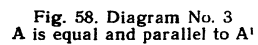


Fig. 59. Firing Diagram

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from the collimator bracket with red enamel. Record the results of test firing in test firing chart.

Note. Record in the Log Book the machine gun displacement (in mils) in azimuth and elevation obtained during test firing.

Firing for Dispersion

After the machine gun has been test-fired, check the stability and values of the dispersion parameters by firing to check dispersion.

In this case fire the machine gun (grips unfixed) with twenty armourpiercing cartridges in bursts, 10 rounds each, at a range of 50 m. The dispersion parameters should not exceed $B_0 = 3.1$ mils, $B_8 = 3$ mils.

The shot holes common point coordinates measured from the theoretical hit point should not exceed $X_0 = 6$ mils and $Y_0 = 9$ mils.

- Notes:
1. Inadvertent deviations of separate holes of each burst from the common point (not more than 2 holes per burst) may be excluded from the calculation.
 2. The dispersion parameters depend to a great extent on the machine gunner's skill - on his ability to "rigidly" hold the machine gun mount in the required position. Therefore, if the results of fire for dispersion is not satisfactory, repeat firing prior to adjusting the sight.

If the bursts middle shot holes common point exceeds the coordinates $X_0 = 6$ mils, and $Y_0 = 9$ mils, perform checking and correct the sight aiming in compliance with the Section "Test Firing in Bursts".

Systematic Errors

As the machine gun mount is test-fired at constant angles of sight and constant ranges of firing, the point of impact for other angles and ranges of firing will be determined with a systematic error. The systematic error, which is the sum of errors of aiming and parallax, is calculated for every angles and range R by the formulas:

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$$\alpha = \alpha_0 \cos \epsilon,$$

where α' - angle of sight determined for basic firing conditions;

α_0 - angle α_0 found in the ballistic charts for aircraft gun armament,

$$A = a \cdot \cos \epsilon + b \cdot \sin \epsilon + 203,$$

where A - distance between the sighting axis and the machine gun barrel bore line, provided the machine gun mount is test-fired for the angle of sight ϵ different from 0° ;

a = 370 mm;

b = 45 mm;

203 - radius of sighting line rotation, when turning the sight in elevation.

A correction for systematic error is introduced with the opposite sign by the machine gunner during aiming.

Systematic errors in mils

Range R, m \ Angle ϵ	100	200	300	400	500
0°	5.8	2.7	1.0	-0.4	-1.7
-15°	5.8	2.7	1.1	-0.3	-1.6
-30°	5.6	2.7	1.2	0.0	-1.1
-45°	5.3	2.7	1.4	0.4	-0.5
-55°	4.9	2.8	1.7	0.8	0.0

The HYB-1M machine gun mount test firing at an angle of sight $\epsilon -30^\circ$ and 400-m range requires, when firing, the introduction of correction only for the range of 200 m or less.

Table of corrections in mils

Range, m	Correction
100	6.0 down
200	3.0 down

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The correction is introduced by the corresponding displacement of the aiming point.

The value of one sight range-finding reticle small division is 10.0 mils.

VII. PROCEDURE OF MACHINE GUN MOUNT, REMOVAL AND INSTALLATION

Removal of Machine Gun Mount

To remove the machine gun mount from the helicopter proceed as follows:

- (a) remove the machine gun as specified in Para 3, Section I;
- (b) disconnect the bunched conductors leading from the controls to the electro-pneumatic valve, helicopter electrical system and firing solenoid and disconnect pneumatic lines;
- (c) undo the bolts attaching the mount bracket to the helicopter truss and remove the mount.

Machine Gun Mount Installation

Prepare the machine gun mount for installation:

- (a) open the shipping box upper cover;
- (b) wash machine gun front and rear units of the cradle in gasoline;
- (c) visually inspect the helicopter truss;
- (d) attach the HYB-1M mount to the helicopter truss with four bolts and lock the bolts in pairs with locking wire;
- (e) position the machine gun in place as specified in Section I.

Removal of Chutes

1. To remove the flexible chute proceed as follows:
 - (a) remove the covers from the mount jacket;
 - (b) turn the gun receiver cover, depress the latch, locking the feed opening assembly with the flexible chute on the machine gun receiver and remove the feed opening assembly. Close the machine gun receiver;

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(c) depress the springs on the rigid chute outlet opening assembly and release the flexible chute.

2. To remove the rigid chute, proceed as follows:

(a) remove jacket 8 (Figs 13 and 14) and disconnect the rigid chute;

(b) undo 4 bolts attaching the rigid chute front section and move the chute up and forward;

(c) disengage the rigid chute rear section from the ammunition box.

Mounting Chutes

The chutes should be mounted in the order reverse to their removal.

Removing and Mounting Ammunition Box

To remove the ammunition box it is necessary to withdraw the stop stud securing the guiding rail of the box in helicopter guides; move the box forward in flight direction.

Mount the ammunition box in the following order:

(a) move the ammunition box in the ventral container on the helicopter aligning the hole in the left guiding rail of the box with the hole in the guide;

(b) fit the stop stud of the box in the operating position.

VIII. REPLACING MACHINE GUN MOUNT FAULTY PARTS AND ASSEMBLIES BY SPARE PARTS

1. Spare Parts

The machine gun mount is provided with spare parts, listed in the General Certificate and in the special Complete List.

2. Procedure of Replacing Machine Gun Mount Faulty Parts and Assemblies by Spare Parts

1. To check the wiring or to replace the firing button, installed in the control grip, undo the screws and remove the cover holding the firing button. Take the firing button out and

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check the solder. In case of replacing the firing button unsolder the wires from the firing button contacts, replace the button by a new one and solder the wires to the new button contacts. Then install the firing button with the wires in position, place the cover and attach it by screws.

2. To check the wiring for serviceability or to replace the 205K button or K4M button of the intercom set, installed on the controls cover, undo the screws, lift the controls upper cover together with the firing buttons (the cover will be held by the wires), check the solder attaching the wires to the faulty firing button contacts and check the wiring for serviceability by ringing out the wire.

If the wire solder and the wiring proper are in good condition, then the button is unserviceable.

To replace the button (205K or K4M) undo two nuts and remove the fastening bolts, unsolder wires from the contacts, remove the caps.

Then put the lower cap on the new button, solder the wires to the contacts, put on the upper cap, insert the button into the cover hole and fasten the caps with bolts and nuts.

After the faulty firing button has been replaced by a new one, check the new button for proper operation as specified in Items 7 and 8, Para 6, Section I.

3. The LOCKING PIN, with which the flexible chute opening assembly is attached to the machine gun feed opening, is furnished in the spare parts set in case of its loss or damage during the operation.

4. The KO WIRE, 1 mm in dia., and $l = 200$ mm, and the 1.5x16xC.2 pin are furnished in the spare parts set in case of the machine gun replacement.

5. When installing a new machine gun, boresight and test-fire it.

The coarse boresighting is performed by adjusting the plugs of the machine gun front attachment on the cradle, and the fine boresighting is performed with the help of the azimuth and elevation adjusting screws of the collimator sight bracket.

To perform the coarse adjustment by the front attachment

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plugs, unlock them by punching out the pins. After this adjustment has been performed, the plugs are locked with new pins, furnished in the machine gun mount spare parts set.

To perform the fine adjustment with the help of the azimuth and elevation adjusting screws, unlock them too removing the locking wire.

After the machine gun has been boresighted and test-fired, the adjusting screws are locked by the KO WIRE, 1 mm in dia., and $\ell = 200$ mm, furnished in the spare parts set.

Note. Lock the adjusting screws with the wire so that the screws could not turn.

6. The ROD LOCKING WASHER furnished in the spare parts set for replacing the earlier installed washer (locking the lock nut), when tightening the rod ball joint assembly after firing every 2000 rounds (if the washer tabs are damaged).

To tighten the rod ball joint assembly unlock the lock nut. For this unbend the locking washer five tabs, tighten the lock nut and lock the washer, by bending the locking washer tabs.

7. The flexible chute link is furnished in the spare parts set in case of replacing of broken or deformed flexible chute link.

To replace the faulty link, remove the flexible chute from the mount as specified in Section "Removing Chutes". To disconnect the faulty link from the flexible chute bend the faulty link lug side tabs. Then bend the lug side tabs of the next link with which the faulty one is engaged.

Install a new link having previously bent its lug side tabs, insert the lugs in the opening of the link, with which they must be engaged, and unbend the lug side tabs.

Then insert the previous link lugs (with the bent tabs) in the openings of the newly installed link and unbend the lug side tabs.

Install the flexible chute on the machine gun mount as specified in Section "Mounting Chutes".

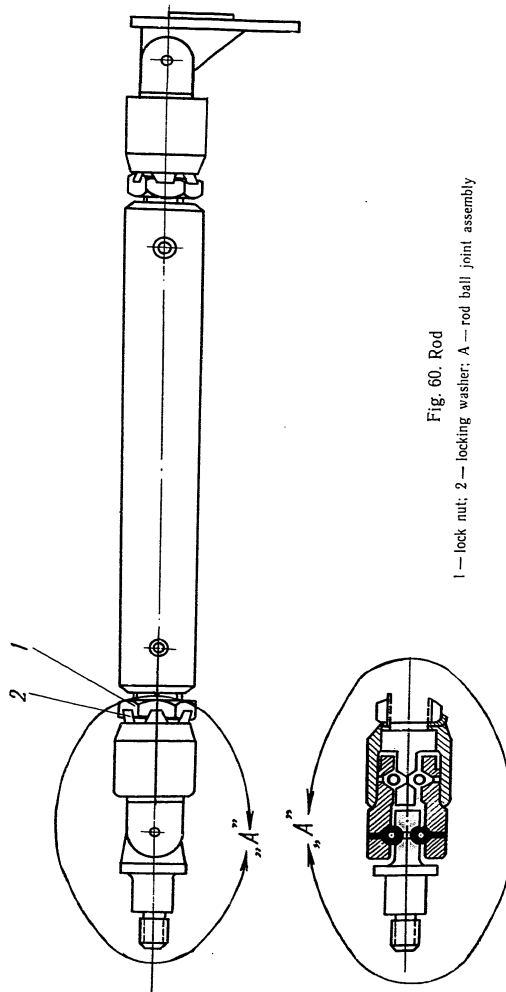
Check the ammunition feed line according to the Section "Checking Ammunition Feed System".

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A P P E N D I C E S

I. HYB-1M MACHINE GUN MOUNT TOOL KIT

The machine gun mount is furnished with the special tool kit, used during its servicing.

NEVER USE NON-STANDARD TOOLS WHEN SERVICING THE GUN INSTALLATION.

Every tool in the machine gun mount tool kit has its purpose, indicated by the inscription on it. The tool kit photo, listing and indicating every tool purpose is given below (Fig.61).

II. INSTRUCTIONS

ON PREVENTING AND REMOVING CORROSION FROM HYB-1M
MACHINE GUN MOUNT MAGNESIUM ALLOY PARTS
DURING OPERATION

General

1. Magnesium and its alloys are the least corrosion-proof out of all metals and alloys, used in the aircraft industry. But the recommended methods of protection, the observation of the storage conditions and also the proper servicing during operation guarantee reliable operation of the magnesium alloy parts.

2. During manufacturing the magnesium alloy parts are protected from corrosion by the following coatings:

- (a) the oxide film of a gold or brown-red colour;
- (b) the AJIF-7 glyptal (zinc-chromate) primer of two layers with hot drying. Priming with the second layer is performed by

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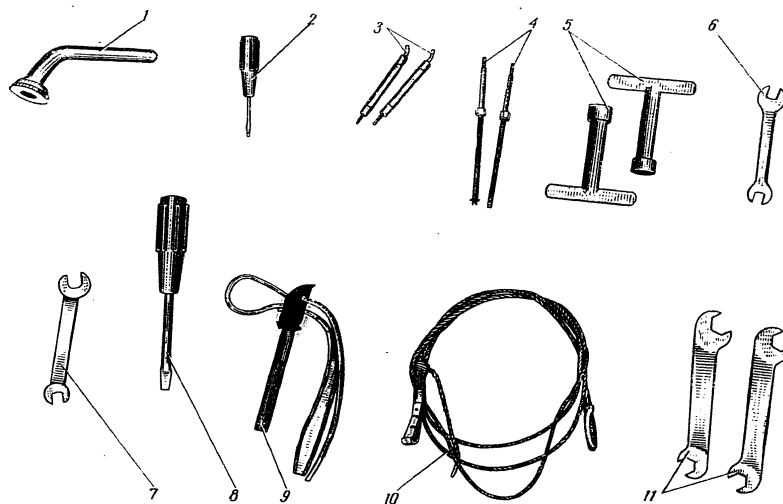


Fig. 61. HVB-1M Machine Gun Mount Tool Kit

- 1 — wrench for cradle front attachment; 2 — screwdriver; 3 — pin for sight; 4 — rods for fixing compensators;
5 — bracket wrench; 6 — wrench, S = 10 — 12; 7 — wrench, S = 11 x 14; 8 — screwdriver for front attachment plugs;
9 — wrench for plug connector nuts; 10 — pulling cable hook; 11 — wrenches for pneumatic system.

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adding the 10% aluminium powder, grade ПAK-3 or ПAK-4 in it;

(c) the perchlorvinyl enamel, grade XB-16 of the preset colour by the drawing, two layers with hot drying. Priming with the first layer of the enamel is made by adding the 2% aluminium powder in it.

3. During the item operation corrosion can appear on the magnesium alloy parts.

The reasons are the following: the coating damage, the flux remains on the parts surface, moisture condensation because of the unsatisfactory ventilation or sudden change in temperature during every twenty four hours, water getting on the parts, chemical reagents (seawater, active gas, etc.).

4. The magnesium alloy corrosion is expressed by paint bulging or by appearing on the parts a friable moist salt sediment of a white colour.

Corrosion can develop very intensively, if the part is not cleaned from the corrosion products in time.

5. To prevent corrosion it is necessary to inspect all accessible parts regularly. In case of revealing corrosion of the parts, also inspect all the parts, difficult of access. The inspection should be performed not less than once a month in spring and autumn and every three months in summer and winter.

In case of seawater getting on the parts inspect the parts immediately, wash them with fresh water and rub them carefully with dry and clean rags.

When inspecting pay special attention to the paint coating condition, the presence of the lubricant on the non-painted parts and the corrosion appearance.

After every inspection remedy all the defects as specified below.

6. The corrosion products should be cleaned off the parts which have the paint bulging and friable moist salt sediment with shallow surface damages as indicated below.

7. Parts, severely affected by corrosion with a great number of dents on the whole surface or with deep dents, and also the parts affected by corrosion in the press-fit places of the bearings should be replaced.

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8. The question of expediency of the part replacement in every particular case should be solved by the unit organization chief engineer.

Methods of Removing Corrosion Products
and Protective Coating Restoration

9. Clean the corrosion products off the parts and restore the coatings right on the helicopter or after removing the parts (depending on their accessibility and the corrosion degree).

10. Using sandpaper No.220 and up (do not use emery cloth) or a scraper thoroughly clean the corrosion products off the places, where the coating bulgings or corrosion right on the parts surface are revealed; clean areas 5 - 10-mm wide around the corrosion several times, remove the remainders from the surface after cleaning with a cloth soaked in gasoline B-70 and then with a dry clean cloth and dry the surface at a temperature of 12 - 35°C for 30 min.

11. After drying apply with a brush or sprayer two layers of acrylic priming, grade AP-10C on the bared metal, while so doing add the 2% aluminium powder, grade MAK-4, i.e. two weight units of the aluminium powder are added for one hundred weight units of the primer. The aluminium powder is added to the primer while mixing thoroughly. Then the primer is diluted until it is of required viscosity by diluent P-5 and filtered through sieve No.015 or through the gauze folded six times. The primer with the aluminium powder is considered good for use in the course of 20 days.

12. Dry every priming layer at a temperature of 28 - 40°C for one hour or at a temperature of 18 - 27°C for two hours whether at a temperature of 12 - 17°C for three hours.

Note. Small scratches covering the area of 2 - 3 sq.cm are coated with one layer of the AP-10C primer with the 2% aluminium powder.

13. After drying the second layer of primer apply a layer

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of the XB-16 enamel with the 2% aluminium powder using a brush (powder is not added to the XB-16 enamel of the aluminium colour).

So, two weight units of the MAK-4 aluminium powder are added for one hundred weight units of enamel, grade XB-16. The aluminium powder is added to the enamel while mixing thoroughly. Then this compound is diluted until it is of required viscosity by diluent P-5 and filtered through the sieve or the gauze folded size times. The enamel with the aluminium powder is considered good for use in the course of 20 days.

Dry the first layer of the enamel at a temperature of 18 - 35°C for four hours or at a temperature of 12 - 17°C for six hours.

14. Apply the second layer of the XB-16 enamel of the required colour and dry it at a temperature of 18 - 40°C for six hours or at a temperature of 12 - 17°C for eight hours.

15. If in the process of drying a part becomes dirty (dust, etc.) wipe the area to be primed with a clean cloth soaked in gasoline B-70 before applying the next priming layer.

16. In the course of work on removing corrosion and on restoration of the primer see that no moisture should not get on the parts.

17. If corrosion is found on the holes remove the corrosion products from them and wash the holes with gasoline B-70, restore the protective cover as indicated above.

Repair

18. When repairing the magnesium alloy parts strictly observe the following requirements:

- (a) the parts of steel, bronze and brass (bolts, bushings, etc.), contacting the magnesium alloy parts, should be zinc-coated, and the parts of aluminium alloys should be anodized;
- (b) press-fit non-zinc-plated bearings into the holes on the AJIF-1 or AJIF-7 fresh primer;
- (c) the tin-plated, silver-plated and copper-plated parts

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as well as steel non-zinc-plated parts and parts made of stainless steel should not contact magnesium alloy parts;

(d) installation of bolts, cotter pins and bushings should be made on the AJIT-1 or AJIT-7 primer without drying or with the use of gun grease. The excessive primer and grease should be removed with a piece of cloth soaked in gasoline. The damaged places of the ball-bearings and bushing rolling and punching should be coated with the AJIT-1 or AJIT-7 primer;

(e) lubricate the thread with the AJIT-1, AJIT-7 primer or the gun grease, except the thread of the zinc-plated wood screws, designed for bonding;

(f) bonding places should be thoroughly cleaned from all kinds of coatings to the bright metal and after mounting and checking they should be coated with nitro-enamel 1201. Steel screws for bonding should be employed only when they are zinc-plated and the terminals, only when they are tinned;

(g) the surface of the holes drilled for rivets in the magnesium alloy parts should be covered with the AJIT-1 or AJIT-7 primer using a brush.

19. The magnesium alloy parts painting damaged during repair, should be restored, as specified above in Section II.

**Materials Used when Removing Corrosion
Products and when Restoring Protective Covers**

Nos	Designation	Grade
1	2	3
1	Glyptal primer	AJIT-7
2	Varnish primer, yellow	AJIT-1
3	Acrylic primer	AT-100
4	Perchlorvinyl enamel of various colours	XB-16
5	Nitro-enamel	1201
6	Diluent	P-5

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1	2	3
7	Pure gasoline, 1st grade	E-70
8	Aluminium powder	ПАК-4 or
9	Expendable materials: sand paper No.220, cloth, calico, flannel or baize, gauze	ПАК-3

III. THE LIST OF THE HYB-1M MACHINE GUN MOUNT PARTS MADE OF MAGNESIUM ALLOY

1. Machine gun cradle.
2. Controls.
3. Collimator bracket.
4. Bracket for attaching the mount to the helicopter truss.

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1.	Accident Prevention, item 9	It is allowed not to hang the light indicator. In this case all the attendants and crew should be warned that during recycling and inspections no priming with fuel, oil and gases should be carried out when the power units are on.
2.	Accident prevention, item 10c.	Transportation bolts should be taken from a single set of ground equipment.
3.	Part I, Chapter I. II. Helicopter Pre-Flight Check, item 12c	To reduce the time for helicopter preparation, do not check the controls operation.
4.	Part I, Chapter I. III. Preparation for Starting, item 9	In addition to operations stated in item 9, check the operation of the following controls: - longitudinal, cross and foot-operated - by shifting the left and the right pitch sticks and pedals over the whole range of their travel; - longitudinal and cross control trimmers - by alternately putting in switches on the left and right control handles; - foot-operated control trimmers - by alternately pressing the pedals.
5.	Part I, Chapter I. Preliminary Operations.	Add item d "Connect the helicopter to the external power plants (AFA-2M or storage battery cart with capacity not less than 220 ampere-hours)".
6.	Part I, Chapter I. II. Pre-Flight Check. Note to item 15.	Pressure in hydraulic system is built up by engaging the 465M pump of the auxiliary system.
7.	Part I, Chapter I. IV. Engines Starting. Note to item 11, subitem "c"	The engines cannot be stopped by means of the "Engine stop" switches, for the latter are not installed in this helicopter. Stop engine by means of engine stopcock.
8.	Part I, Chapter I. V. Engines starting, item 11, subitem "c", notes.	Operations stated in the subitem "g" should be carried out in accordance with the regulations of the engine operating instructions.
9.	Part I, Chapter I. V. Engine Warm-Up and Testing, item 14.	When carrying out operations stated in item 14, during checking the anti-icing system, the engine duty should be selected in accordance with the instructions on the helicopter piloting.

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10.	Part I, Chapter I. VI. Engine Cut-Off; note to item 6	In case of stopping the engine by means the fire valve the possibility of further operation of the EP-23A pump is discussed with the Manufacturer's representative.
11.	Part I, Chapter II. I. Preliminary Operations, item 7.	When carrying out operations stated in item 7, the hood hatch valve should be opened at a hydraulic system pressure of 60 kg/sq.cm.
12.	Part I, Chapter II. II. Post-Flight Check. 1. Engines and Fan Unit, item 3.	When carrying out post-flight check according to item 3, the engine separate control handles should move freely, without jerks and jamming as well as without appreciable play.
13.	Part I, Chapter II. II. Post-Flight Check; 7. Fuselage, Landing Gear, Wing (below) and Tail Boom (outside); item 6	Tire pressure of the landing gear wheels should be checked by means of a pressure gauge.
14.	Part I, Chapter II. III. Operations Carried Out during Post-Flight Check a) Every 100 hours of heli- copter flight, items 10 and 11.	Technical nitrogen pressure in the front shock ab- sorber leg and in the main landing gear shock ab- sorbers should not be checked.
15.	Part I, Chapter II. III. Operations Carried Out during Post-Flight Check. b) Every 50 hours of heli- copter flight, item 24.	In addition to operations stated in item 21, check the technical nitrogen pressure in the front shock absorber leg and in the main landing gear shock ab- sorbers (see part II, chapter III, landing gear, item 21).
16.	Part I, Chapter II. III. Operations Carried Out during Post-Flight Check. 8. Hydraulic System of Heli- copter, item 24.	Sediments are drained from the coarse mesh filters of the hydraulic system. Wash the filters, after they are removed.
17.	Part I, Chapter III. II. Training Helicopter with Fuel. 3. Training Helicopter by Airborne Refueller, items 28 and 29.	The position of the fuelling valve of the IV-th group of fuel tanks is indicated by a control electric lamp with yellow light filter.
18.	Part I, Chapter IV. W. Every 50 hours of heli-	Because of the reducer underframe design alterations no welded seams inspection near the brackets is

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	copter flight; fuselage, tail and end booms; item 4.	allowed.
19.	Part I, Chapter IV. W. Every 50 ⁺ 5 hours of helicopter flight; Landing gear.	When checking high pressure chamber charges of main landing gear shock absorbers, one can use charts shown in fig. 43 only when the rods of these chambers in the left and the right shock absorber legs are levelled.
20.	Part I, Chapter IV. Y. Every 100 ⁺ 5 hours of helicopter flight; Engine and main reducer, item 15.	This helicopter is provided with exhaust pipes having easily detachable joints. Therefore, there is no need of checking the exhaust pipe fastening bolts for tightness. Inspect the yoke of the easily detachable joint. Herein pay special attention to the absence of longitudinal cracks in the middle of the yoke. No helicopter flights or engine tests with cracked yokes are allowed.
21.	Part I, Chapter V. III. Operation of Anti-Icing System, item 1.	In flight, when suddenly entering the icing zone, the icing signal lamp flashes in the pilot's cabin. If ice appears on the glasses and the helicopter begins to vibrate, switch on the anti-icing system for a 60 sec. duty cycle. If there is no ice formation and vibrations, switch on 20, 40 or 60 sec. duty cycles depending on the ambient air temperature.
22.	Part I, Chapter V. W. Sequence of Loading, Placing, Fastening, Transporting and Unloading Cargoes, item 5.	In order to carry people, this helicopter can be equipped with two middle rows of seats from No. 32 up to No. 65 (in addition). The sequence of taking seats should correspond to their numbers.
23.	Part I, Chapter V. W. Sequence of Loading, Placing, Fastening, Transporting and Unloading Cargoes; Helicopter Preparation for Loading, item 3.	When preparing the helicopter for loading on the ground, do not open the central cargo bay but open the cargo shutters and lower loading ramps.
24.	Part I, Chapter VI. I. Engine Operating Peculiarities.	After item "6" add item "7" to the effect: "7. To maintain temperature of oil entering the turbocompressor part of the engines within +60°C to 80°C during the flights under icing conditions, one should install shutters at the rear side of the oil radiators when the ambient air temperature is

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constantly +5°C. The passage area of these shutters should be adjusted prior to the flight, on the ground, according to the following table:

Shutter passage area	Ambient air temperature (°C) near the ground
1/6 to 1/5 passage area open (6 to 8 mm along the sector chord)	+5°C to +10°C
Fully closed	below -10°C

NOTE: At an ambient air temperature from +5°C to +10°C the fan blades, as a rule, should be fully open.

In case of need, at these air temperatures it is allowed to maintain the oil temperature (from +60°C to +80°C) by slightly closing the fan blades.

25. Part I, Chapter VI.
II. Main Reducer Operating Peculiarities.

26. Part I, Chapter VIII.

27. Part I, Chapter IX.
I. Main External Suspension System, item 8.

28. Part II, Chapters II and VII.
Care of Main Rotor Blades.
Corrosion-Preventive Measures.
(5) Main Rotor Blades.

29. Part I, Chapter IX.

II. External Suspension Operation

When carrying out operations stated in section "Main Reducer Operating Peculiarities", after item "1" add item "2" to the effect: "After draining oil screw in and lock the stoppers on the oil radiators draining".

When operating the helicopter under tropical climate conditions, pay special attention to the condition of parts made of magnesium alloys. The above parts should be maintained in accordance with the instructions stated in the section: "Maintenance of Magnesium Alloy Parts". (Part II, Chapter VII of this Manual)

8. In addition to the operations stated in item 4, install special guard 20-2750-800 under the opening of the central cargo bay.

The main and the tail rotor blades should not be kept out-of-doors or under a shed for more than 24 hours under the tropical climate conditions.

After section "II. Checking the Suspension System Serviceability" add new section to the effect:

IIa. Cargo Preparation for Transportation on External Suspension

Cargoes to be carried on the helicopter external suspension should be specially inspected and prepared.

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Cargo weight and its center of gravity position should be indicated (if necessary, the cargo weight and its centering can be additionally checked by lifting it with the help of a mobile crane through a dynamometer and clamping system). The cargo is prepared by a crew of workers under the supervision of an engineer or technician.

The cargo preparation includes the following procedures:

- a) Determination of distance between the cargo suspension points. This distance should not exceed 3 m when transporting cargoes having up to 40 m overall dimensions in horizontal plane and 6 m when transporting larger cargoes.
- b) Inspection and testing of the suspension units reliabilities.
- c) Checking for the reliable fastening of all the devices mounted on the cargo (pay special attention to the fastening of movable parts of cargo mechanisms, to the fastening of storage batteries and eliminating the possibility of short-circuits, to the tool box fastening, to the fastening of various covers, superstructures and other equipment which in the course of ground operation is kept from displacement by gravity).
- d) Connection of suspension hooks to the suspension units (the hooks should be suspended with their openings turned inside the pyramid formed by the suspension system ropes).
- e) Determination of cargo position when suspended on a mobile crane.

The cargo base should be practically parallel to the ground (the angle of cargo base inclination should not exceed 8 to 10°). In case of a larger angle, select another suspension points or use extensions.

- f) Checking for the absence of suspension rope contacts with cargo sharp edges (in the points of such contacts install soft pads on the cargo or apply protectors over the ropes. The protectors should be fixed to avoid longitudinal displacement).

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30. Part II, Chapter II,
item 9
31. Part II, chapter III.
Landing Gear
32. Part II, Chapter V.
1. Main Rotor Control
Adjustment.
33. Part II, Chapter VI.
Elimination of Non-Conical
Main Rotor Motion.
A. For helicopters with bla-
des drwg. 32700-00.
1. Preparation for taking
photos, note to item 9,
subitem 2.
34. Part II, Chapter VIII.
III. Mooring Tail Rotor Blades.
- In order to suspend the cargo, one or two specially trained ground operators are appointed. In the process of cargo suspension the ground operators should wear protective anti-dust goggles and gloves.
- No covers should be applied over the main rotor blades in case of more than five days intervals between the helicopter flights under the tropical climate conditions (in clear weather). To prevent from blade flaps damaging when applying covers, use protective boxes.
- The B4101-100 main landing gear shock-absorber legs are installed in this helicopter. Therefore, when checking charges of high- and low-pressure shock-absorbers, follow the chart scale of a corresponding number (fig.43).
- When adjusting the main rotor control, it is allowed to connect the 465M pump to the airfield power plant.
- When eliminating non-conical motion of the main rotor focusing can be carried out using the distance scale, mark 15.
- In this helicopter any three blades of the tail rotor are protected with separate covers No. 50-9603-10 and one blade and the rotor hub are protected with cover No. 50-9603-11.

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tions

III. Services of the Bureau
 a. Internal Operations:
 Part I, Chapter II
 Helicopter Operations
 a. Local Service: Section

1. The first step in the process of identifying a problem is to determine the nature of the problem. This involves a thorough understanding of the situation and the factors that are contributing to the problem. Once the nature of the problem is understood, the next step is to identify the causes of the problem. This involves a detailed analysis of the situation and the factors that are contributing to the problem. Once the causes of the problem are identified, the next step is to develop a plan to address the problem. This involves determining the steps that need to be taken to address the problem and the resources that will be needed to implement the plan. Once a plan is developed, the next step is to implement the plan. This involves carrying out the steps that have been identified in the plan and monitoring the progress of the implementation. Finally, the last step in the process is to evaluate the results of the implementation. This involves determining whether the problem has been solved and whether the resources have been used effectively.

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1. The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, regarding the land owned by the United States in the State of Nevada:

2. The total land owned by the United States in the State of Nevada is 1,100,000 acres.

3. The land is owned by the United States in several different ways:

4. (a) 100,000 acres are owned by the United States in fee simple.

5. (b) 200,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

6. (c) 300,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

7. (d) 400,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

8. (e) 200,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

9. The following is a list of the land owned by the United States in the State of Nevada:

10. (a) 100,000 acres are owned by the United States in fee simple.

11. (b) 200,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

12. (c) 300,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

13. (d) 400,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

14. (e) 200,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

15. The following is a list of the land owned by the United States in the State of Nevada:

16. (a) 100,000 acres are owned by the United States in fee simple.

17. (b) 200,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

18. (c) 300,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

19. (d) 400,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

20. (e) 200,000 acres are owned by the United States in fee simple, subject to a trust for the benefit of the Indians.

1. The first step is to identify the problem. In this case, the problem is that the company is not meeting its sales targets. The manager needs to determine why this is happening and what can be done to improve performance.

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the literature of the world is full of such evidence. The fact is that the green signal is the only one that is normal. The green sig-

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39.	/Part I, Chapter IV. Recycling. V. Every 100±5 hours of helicopter flight. Hydraulic system.	Introduce item "B" to the effect: "B. Check for the operation of feed shifting mechanisms from the main hydraulic system to the duplicating one, for which purpose do the following: a) Open hoods, ports and hatch of the reducer bay; b) Connect the helicopter electric system to the ground power unit; c) Shift the controls to neutral position. Herein the readings of the longitudinal, cross and foot-operated trimmer indicators should be neutral (at 0°) and the control handle should be in the middle position which corresponds to the YUB reading ~ 2° (slide block travel from the lower position about 47 mm); d) Wedge up upper ends of the rods of longitudinal, cross, foot-operated control and total pitch control together with slide valve rockers by means of special devices: - for longitudinal control - device 6368/0043A - for cross control - device 6368/0044A - for foot-operated control - device 6350-0348 - for total pitch control - device 6368-0038; e) Build up working pressure in the hydraulic system by switching on the 465M pump (or by using airfield hydraulic cart); f) Apply the following forces in the helicopter control system: - longitudinal control - 30±10 kg (forward, reverse) - cross control - 20±10 kg (left, right) - foot-operated control - 10±15 kg (left pedal, right pedal) - total pitch control - 20±10 kg (up, down) with the help of devices: - for helicopter and total pitch control handle - 64700/1303; - for foot-operated control pedals - 64700/1321;

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g) When the emergency feed switch operates and the main hydraulic system is switched over to the duplicating one, the green lamp on the middle pilot's panel goes out and the indicator "Switch off main hydraulic system", "Duplicating hydraulic system on" flashes.

NOTE: When the controls are in their free position, the clearance between the bolt head and the limit switch rod with special spring device should be 2.5 to 0.7 mm as determined by microswitch click.

Dynamometer devices for measuring forces are fixed in the middle part of the control handles of the helicopter and total pitch control and the foot-operated control pedals.

h) Disconnect power units and hydraulic cart from the helicopter panel (if they were connected).

i) Remove special devices from rods and controls, reinstall standard fasteners.

j) Close hoods, ports and reducer bay hatch".

When carrying out operations stated in item "1" check the emergency door release mechanisms in the following sequence:

a) Disconnect storage batteries and ground power units. Disconnect power from squibs of all doors.

b) Provide for the good condition of doors after the operation of the emergency door release mechanisms. For this purpose support the doors from the outer side.

c) Pull the emergency release handle as indicated in the door plates. At this time the emergency release pins must be disengaged simultaneously and without jamming.

d) Separate the doors from the fuselage, inspect locks and hinges of the emergency release and, in case of their good condition (in case of damages make proper repair), reinstall the doors.

Part II, Chapter IV.
Fuselage and Wing Maintenance.
III. Maintenance of Emergency Door Release Mechanisms; item 1.

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Part IV, Chapter IV:
Scheduled Maintenance Operations.
1. Every 50 hours flying hours:
fuselage, tail boom and pylon.

NOTE: automatic door release should be checked by specialists together with members of helicopter crew.

Unauthorized persons are not allowed to enter the helicopter or near it when checking the emergency door release mechanisms.

The section "Operations Carried Out during Post-Flight Checks Every 50-55 hours of flight" must be supplemented with item "6" to the effect:

2) Check the electrical system of the emergency door release system.

The electrical circuiting of the cargo compartment must be checked in accordance with the following instructions when carried out: check the electrical system of the cargo compartment every 50 hours of flight, once a month.

Check the electrical system of the cargo compartment with the following instructions: the cargo compartment is not allowed to stay in the helicopter for more than 20 minutes during these checks.

The sequence of checking is as follows:

- 1) Switch off ground power and ground power units.
- 2) Disconnect the power supply to the cargo compartment from the main electrical system.
- 3) Disconnect the power supply to the cargo compartment from the main electrical system.
- 4) Energize the storage battery bar from the batteries on ground power units. While checking the electrical circuits of the emergency door release of the cargo compartment, preliminarily check for the availability of emergency release fuses in the PE (control relays) of the left and the right generators.
- 5) Supporting the door from the outer side, pull the emergency release handle and remove the door. At this time all the four control lamps should flash.

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For the crew cabin doors

When pressing upon any microswitch all the four lamps must flash.

When pressing upon any pair of microswitches simultaneously (one upper, one lower - for the navigator's door; one left, one right - for the rest) all the four lamps must keep flashing.

When simultaneously pressing upon the two lower or two upper (for the navigator's door), two left or two right (for the rest doors) microswitches, all the four lamps must go down.

For the cockpit compartment doors

When pressing upon any upper microswitch all the four lamps must keep flashing.

When pressing upon any lower microswitch the lamp must go down near each plug (see test diagram 27200-6).

When simultaneously pressing upon any pair of microswitches (upper-lower), one lamp must go down near each plug. When pressing upon the upper or lower pair of microswitches all the four lamps must go down.

NOTE: Prior to checking the electrical circuits of the navigator's door emergency release, disconnect the plug from the rope cutting squib and connect the control lamp.

The control lamp should flash or go down similar to the control lamps connected to the navigator's door squibs.

- f) If not performing any of the above procedures, de-energize the helicopter and eliminate the defect, then repeat checking according to items "d" and "e" of the given section.
- g) After checking the emergency release system, reinstall the doors, connect the plugs to the squibs and lock them as well as seal all the emergency door release mechanisms.

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42. Part I, Chapter V.
 Helicopter Operation in Flight.
 III. Anti-Icing System Operation.

In section 3 "Anti-Icing System Operation" add
 item "4" to the effect:

"4. To increase reliability of the main rotor
 anti-icing system, one should heat up this system
 every 15 + 5 days. For this purpose switch the
 system on for a 40 sec. duty cycle during 15 minu-
 tes at an ambient air temperature not above +15°C.

The above heating procedure should be carried
 out:

- a) in helicopters under continuous flight opera-
 tion, during any of the daytime flights;
- b) in helicopters free from flights - on the
 ground, simultaneously with periodical engine
 running.

In this case, to avoid damaging nose parts of
 the main rotor blade sections, heat up the anti-
 icing system on a grassy field or area specially
 cleaned from small stones and other foreign things.

NOTE: In those helicopters where the liquid
 anti-icing system of the tail rotor is
 introduced, the latter should be disen-
 gaged (both in flight and on the ground).

43. Part II, Chapter V.
 Helicopter Control Adjustment.
 IV. "Pitch-Gas" Control Adjust-
 ment.

The following sequence of the "pitch-gas" control
 is established for the given helicopter:

1. Checking and adjustment of "pitch-gas" control
 is carried out after the total pitch control ad-
 justment.

Herein it is necessary, that:

- a) At the extreme lower position of the "pitch-
 gas" handle and medium correction the rockers
 on the frame No.1 should bear against their
 upper rests and the angle of the HP-23 lever
 rotation should be equal to 15° - 18°.
- The clearance between the gas rocker and the
 rest arranged on the 8-th nose frame of the
 fuselage should be equal to 0.5-1 mm.

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b) At total pitch indication equal to $8^{\circ}30'$ to $9^{\circ}30'$ and full right correction, the rockers on the frame No.1 should bear against their lower rests and the HP-23 levers should approach their large gas rests, but without much effort.

c) At total pitch indication equal to 8° and full left correction, the HP-23 indicator dial reading should be equal to $24^{\circ}-28^{\circ}$.

N O T E: When lowering the "pitch-gas" handles, starting from $9^{\circ}-6^{\circ}$, the correction handle starts to rotate from its extreme left position to the right and at $9^{\circ}-1^{\circ}$ the correction handle will occupy its middle position.

Widening or narrowing of the correction range is achieved by adjusting the rests of the correction handle revolution.

d) Difference between the dial readings of the right and the left engines over the entire range of adjustment should not exceed 2° (as finally checked during "hot" adjustment).

2. Start the engines and check their operation at low gas. At the extreme lower position of the "pitch-gas" handle and extreme left correction the turbo-compressor speeds should be within 51.7 per cent ± 1 per cent.

3. After eliminating non-convicity of the main rotor, take the "pitch-gas" readings which should correspond to the values given in the table below (for moored helicopter):

Pitch readings by indicator (deg.):	Left correction		Right correction	
	Turbine: r.p.m.	YMP indicator: (deg.)	Turbine: r.p.m.	YMP indicator: (deg.)
1	-	15-18 ^x	7600-8000	32-36
5	-	-	8400-8650	60-68
8	-	24-28	8400-8650	84-92
$9^{\circ}30'$	-	-	8500-8600	96-100 ^{xx}

x - medium correction

xx - take-off duty - spontaneous turning of the correction handle to the left.

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NOTE: 1. The HP-23 dial readings at left correc-
tion should be checked only when the
engines are out of operation.

2. Running time at turbine speed equal to
7600 r.p.m. and $\pm 10^\circ$ should not exceed
three minutes.

4. When checking the "pitch-gas" readings during the
engines operation, the permissible deviation from
the "cold" readings is $\pm 10^\circ$ by YNPT-2.

5. To obtain the "pitch-gas" readings indicated in item
3, it is allowed to change the amount of the total
main rotor pitch by changing the length of blade
rotating rods.

When extending the rods, the speed will be reduced
and when shortening them it will increase. One revo-
lution of the blade rotating rod changes the free
turbine speed about 50 to 100 r.p.m. Recommended
length of vertical rods (drwg. B1920-900) is 732 to
747 mm (320 to 335 mm between tip ends).

CAUTION: The blade rotating rod lengths should
be changed to equal amounts in order
not to disturb blades alignment.

NOTE: When adjusting on the ground and in flight,
the short-time speed increase of the free
turbine up to 8700 r.p.m. is allowed (not
more than during 5 minutes).

The operating time at this r.p.m. is re-
gistered and put down into the log.

Total running time should not exceed 5 per
cent total engine life.

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44.	Part I, Chapter V. Helicopter Operation in Flight. III. Anti-Icing System Operation.	In the section "Anti-icing System Operation" add items "5" and "6" to the effect (for this series of helicopters): 5. In the helicopters provided with liquid anti-icing system of the tail blade this system is engaged simultaneously with that of the main rotor, glasses and engine inlets. Herein the DHA-1 pump which supplies alcohol-glycerine mixture to the tail rotor is engaged. Simultaneously with switching in the pump the signal lamp "Anti-icing system on" shows a green indication of the system proper operation. 6. At normal working duty of the DHA-1 pump, corresponding to the electric heating anti-icing system operation at 20 and 40 sec. duty cycle, at full tank (20 l.), the system operates during 18 to 23 minutes. At forced duty it operates during 15 to 16 minutes. When there is no working liquid left in the anti-icing system service tank, the lamp "Anti-icing system on" arranged on the pilot's module instrument panel goes down. In case of a prolonged flight under the icing conditions the flight technician does not wait for the signal lamp "Anti-icing system on" to go down and, judging by the time and duty cycle, replenishes the system with working liquid from additional containers (canisters) in the following sequence: - by means of the DHA-1A pump (arranged on the cargo compartment structure near frame 16) forces the liquid from one of the canisters to the service tank; - when this vessel is empty, in case of need supply liquid from the second canister. Consumption time of one canister (20 l.) at normal working duty is 18 to 20 minutes, at forced duty - 10 to 11 minutes.

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45.	Part II, Chapter IV. Fuselage and Wing Maintenance.	<u>CAUTION:</u> To avoid working liquid overflow when using additional containers the above-mentioned sequence of pumping must not be altered. Chapter IV "Fuselage and Wing Maintenance" should be supplemented with section "VII" to the effect: <u>VII. Maintenance of Tail Rotor Anti-Icing System</u> <u>1. Adjustment of Liquid Consumption</u> a. When installing or repairing the anti-icing system devices, when performing helicopter for winter operation or in case of detecting excessive or insufficient anti-freeze liquid used to the tail rotor one should adjust the liquid consumption. This adjustment is carried out by pumping liquid through the system up to the tail rotor collector into a separate vessel as follows: a) prime the tank with antifreeze liquid (15 per cent glycerine and 85 per cent alcohol by volume) into the filler throat through a fine mesh strainer funnel or pump it by means of the FMA-1A hand-operated pump; b) apply rubber hose onto the jet of the tail rotor distributor. The hose length should not exceed 0.5m; c) engage the OUH-1 pump to its normal duty and measure the liquid consumption. Measuring should be performed as follows: When switching on the OUH-1 pump put a vessel under the hose. In 2 to 3 minutes of the pump operation shift the hose into a measuring tank and simultaneously engage the stopwatch. Carry out pumping during two minutes. At the expiration of that period of time shift the hose from the measuring tank into the previous vessel and disengage the pump. Then take readings of the volume of liquid contained in the measuring tank and determine the consumption per minute. The liquid consumption at normal duty of the OUH-1 pump should be equal to 350 ± 100 cu.cm/min, at supply voltage $27 \text{ V} \pm 10$ per cent and temperature -10° C.

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At all the other ambient air and liquid temperatures the liquid consumption is re-calculated using this

formula: $Q_t = 850 / 1 + 0.01 \Delta t$ where:

Q_t - liquid consumption at temperature $\Delta t^\circ C = t_H + 10^\circ$ and
 t_H - ambient air and liquid temperature at the moment of adjustment.

Consumption allowance is also re-calculated using the formula:

$\Delta Q_t = 100x / 1 + 0.1 \Delta t$, where:

ΔQ_t - consumption allowance at the temperature of adjustment.

N O T E: Liquid consumption is checked when the throttle valve needle is locked.

At forced duty the liquid consumption should be equal to not less than 1250 cu.cm/min at $t_H = -10^\circ C$.

At other temperatures the consumption is re-calculated using the formula: $Q_{tf} = 1250x / 1 + 0.1 \Delta t$, where Q_{tf} is minimum consumption of antifreeze liquid at the forced duty of the OUM-1 pump and temperature $\Delta t^\circ C$.

d) check operation of the OM-16A indicator for which purpose fill 3 to 4 l. of liquid into the tank and engage the OUM-1 pump for a normal duty. Herein the hose applied over the jet should be lowered into a vessel. When the pump is switched on, the red signal lamp flashes. This lamp goes down as soon as there is no liquid in the tank.

II. Checking Liquid Supply to Tail Rotor Blades

The amount of liquid supplied to the tail rotor blades is checked when the helicopter is prepared for winter operation and when the tail rotor is replaced.

Prior to checking liquid supply, disconnect the hose from the anti-icing system collector, wash the blade channels with pure gasoline by means of a syringe and then blow out with compressed air. During this procedure gasoline should go out from all the holes. After washing out channels, paint the front edges of the blades over their entire length.

When painting, use one of the following compositions:

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Composition I. At an ambient air temperature below zero. rectified alcohol - 58 g., calophony - 2.8 g., glycerine - 8 g., chalk (tooth powder) - 30.5 g., violet ink (liquid) - 0.7 g.

Composition II. At an ambient air temperature above zero: water - 81 g., sugar - 4.8 g., glycerine - 1.2 g., chalk (tooth powder) - 30.5 g., violet ink (liquid) - 0.7 g.

NOTE: 1. When there is no ink, use composition without it.

2. When painting blade edges see to it that the holes for liquid supply from the channels were not clogged.

After finishing preparation for liquid supply checks, it is necessary to switch on the anti-icing system for 5 minutes in cruising flight or on the ground, at free turbine speed 78 to 83 per cent. The duty cycle is selected depending on ambient temperature (ref. to chapter "Helicopter Operation in Flight"). After stopping the transmission, inspect the blades to determine liquid supply.

The front edges should have traces of liquid on both sides of each blade over the entire length of holes.

NOTE: The total length of non-moistened part of the blade should not exceed one-third of the whole length to be moistened.

III. Washing Anti-Icing System

The anti-icing system should be washed with rectified alcohol twice a year when preparing the helicopter for summer and winter operation. For this purpose do the following:

- drain the remaining liquid from the system;
- fill 3 l. of pure alcohol into the tank;
- with the rotor in motion, switch on the anti-icing system and continue its operation until all the alcohol is used.

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46.	Part II, Chapter IX. Replacing Separate Units. XVII. Replacing Tail Reducer 1. Dismantling	This series of helicopter is provided with tail rotors having liquid anti-icing system. Therefore, when dismantling the tail reducer, after carrying out operations described in item 10, one should: a) Unlock and turn off the nuts of the bolts fastening the tail reducer housing and remove the bolts (two lower bolts at the same time fasten the pipe line bracket to the tail reducer). b) Remove the housing from the tail reducer shaft. c) Remove the yokes fastening the anti-icing system pipe line to the tail reducer housing. Then carry out operations stated in item 11.
47.	Part II, Chapter IX. Replacing Separate Units. XVIII. Replacing Tail Reducer II. Assemblage	In the process of mounting the tail reducer, when installing the tail rotor with liquid anti-icing system, after carrying out operations stated in item 6, one should: a) Install the housing onto the reducer shaft and fix it with bolts. by means of two lower bolts simultaneously fix the pipe line bracket. Pull down nuts and lock them with cotters. Then carry out operations described in item 7.
48.	Part I, Chapter X.	This helicopter is provided with the inert gas system. The sequence of this system operation and maintenance is represented in the newly introduced section to Chapter VII. <u>Inert Gas System Operation</u> 1. PURPOSE The inert gas system is intended to prevent from formation of explosive mixture of fuel vapours and atmospheric oxygen within the fuel tanks. Carbon dioxide (CO ₂) is used as the inert gas. This gas is contained in three eight-liter cylinders which are installed over the ceiling of the cargo compartment between the frames Nos. 27 and 28. The cylinders (OCY-5) are filled with liquid dehydrated carbon dioxide, 5.7 kg in each cylinder, and are provided with remote-controlled squib seal.

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NOTE: When operating the helicopter in tropical countries where the temperature at the airfield reaches +50°C, the weight of fire extinguisher charge should be reduced to 4.4 - 0.15 kg.

If it is necessary to use the inert gas system, put in the pressure switch contained on the flight technician's instrument panel. At this time the squibs of all the three cylinders explode, open the cylinder head seals, and gaseous carbon dioxide enters through the pipe line into the PH-50K reducer, then, at a reduced pressure, to a dosing calibrated jet and then - at still lower pressure - to the upper part of fuel tanks.

2. Cylinders Replacement

After using the cylinders, replace them as follows:

a) Disconnect all the pipe lines from the seals. Install stoppers in the sleeves and pipe lines.

b) Remove fuses from the seal and take out used squibs. Install stoppers instead of fuses.

c) Set the lock to the seal lever.

d) Release the yokes fastenings the cylinders and remove the cylinders.

e) Inspect the new cylinder, make sure it is intact and see to the availability of stamps.

f) Weigh the cylinder and check the charge weight. Weight of charge should be 5.7 ± 0.1 kg.

At a temperature of +50°C weight of charge should be 4.4 - 0.15 kg.

g) Reinstall the cylinder, remove stoppers from the sleeves and connect all the pipe lines.

h) Install new squibs into the seal (when it is de-energized), reinstall the fuses, pull down the lock nut and fasten it with wire.

Check the reliability of fuse contacts by means of an ohmmeter.

i) Disconnect the lock from the seal lever.

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3. INERT GAS SYSTEM MAINTENANCE

a) In the process of helicopter operation regularly see to the condition of the inert gas system, check the reliability of pipe line and cylinders fastening, condition of system operation signal stopper as well as air-tightness of all joints.

b) Every 50 hours of helicopter operation, but not less than once in six months, check the weight of cylinder charges.

When adjusting main rotor of this helicopter, see to the following regulations:

1. Measuring flap angle of rectangular main rotor blades should be carried out using angle gauge (dwg. 90-9400-105) which is installed on the lower surface of the blade.

2. When measuring the flap to adjust control blades of the main rotor, the value of flap angles in respect to the lower surface of the blade should be:

- initial average flap angle for each blade, when installing a new set of blades, should be 0°;
- maximum permissible average flap angle for each blade when adjusting vertical alignment should be not more than 2° upward or downward in respect to the blade lower surface;

- at the above average flap angles, the difference between the average values of the flap angles on three flaps of the given blade should not exceed 2°;
- the average value of the flap angle of each of the three flaps on the given blade is determined by measuring three sections of the flap (at the ends and in the middle).

Permissible difference in the flap angle values of three sections of each flap should not exceed 2°.

49. Part II, Chapter VI.
Eliminating Non-Centrical Motion of Main Rotor.
1. For Helicopters with
Blades dwg. 90700-00.
2. Main Rotor Adjustments

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50.	Part I, Chapter II. Post-Flight Maintenance. III. Operations Carried Out during Post-flight Check; a) Every 10±5 hours of helicopter flight, item G.	Apply effort (forward, aft), equal to 2.5 kg to the pilot's control stick at a radius of 833 mm. At this time the total springy play should not exceed 7 mm from neutral position. When determining amount of play in the lateral control, apply an effort of 2.5 kg to the pilot's control stick to the left and right, at a radius of 833 mm. The total springy play should not exceed 7 mm from neutral position. When determining the amount of play in the foot-operated control, apply an effort of 5 kg to the center of the co-pilot's pedal. At this time the springy play should not exceed 5 mm. No free play and shocks in the control system are allowed.
51.	Part I, Chapter IV. Overriding IV. Every 10±5 hours of helicopter flight. Helicopter control, item 2.	The clearance between the rods and the guide rollers should not exceed 0.5 mm. Each roller should be checked separately. In the process of checking the rods should be pressed against the other rollers with an effort of 2 to 3 kg.

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52.	Part II, Chapter V. Helicopter Control Adjustment. V. Adjusting "Pitch-Gas" Control in Helicopter with Main Rotor Blades drwg. B2800-00.	After carrying out steps 1 and 2 of item "1", perform the procedure for item "2" and "3" in the order: "2". Check the "pitch-gas" control at the "pitch-gas" control in the helicopter with the main rotor blades drwg. B2800-00. The "pitch-gas" control lever is fixed in the "pitch-gas" control.

Nos. off	Pitch-Gas Control	
	Left Rotorblade	Right Rotorblade
1	11 to 12	11 to 12
2	13 to 14	13 to 14
3	15 to 16	15 to 16
4 ± 30'	17 to 18	17 to 18

* - normal correction.

3. Check the "pitch-gas" characteristics in the
"pitch-gas" control.The characteristics should correspond to the follow-
ing table:

Alt. ft.	Rotor turbine R.P.M.	Hovering weight lb.	Remarks
0 to 4	78 to 80		
5 to 9	81 to 83		Check up to 10 min. is allowed for the rotor turbine to warm up.
10 to 15	84 to 86	not less than 6	Rotor power is taken off one

Sequence of Checking:

- Load the helicopter up to normal flight weight.
- Start and heat up engines.
- Shift the correction handle to the right as far as
the rest when the "pitch-gas" handle is in its lower
position (1° pitch by Yds.).

NOTE: All further checks of the "pitch-gas" sys-
tems are performed at the extreme right
correction.

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- Smoothly increase the pitch of the main rotor blades to 40° by the time the rotor speed increases to the maximum value in the pitch control system.

- Check to make sure that the main rotor blades are not damaged and that the main rotor blades are not damaged.

- Increase the pitch of the main rotor blades to 40° by the time the rotor speed increases to the maximum value in the pitch control system.

- Check to make sure that the main rotor blades are not damaged and that the main rotor blades are not damaged.

- Check to make sure that the main rotor blades are not damaged and that the main rotor blades are not damaged.

- Check to make sure that the main rotor blades are not damaged and that the main rotor blades are not damaged.

- Check to make sure that the main rotor blades are not damaged and that the main rotor blades are not damaged.

53. Part II, Chapter VII.
Helicopter Controls and
Adjustment.
Fig. 49
54. Part II, Chapter VII.
Corrosion-Preventive
Measures and Storage of
Helicopters.
Fuel System Processing.

- Collective pitch will remain on from 0 to 40° in this helicopter.

- The longitudinal control is fixed with the collective pitch control lever set to low r.p.m.

- This helicopter is furnished with a new set for engine preservation (Fig. 49-10).

55. Part II, Chapter VII.
Corrosion-Preventive
Measures and Storage of
Helicopters.
1. Corrosion-Preventive
Measures.

- In this helicopter zinc-plated parts are used for cadmium-plated ones.

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50. Part I, Chapter IV.
 IV. Every 100th Flying Hours.
 Add item h

h. Heating and Ventilation

1. Remove the pop-off plug from the exhaust pipe around to inspect it for cracks and other damage.

Check power gas turbine for leaks, joints, cracks, etc. and repair as necessary.

Check the engine for leaks, cracks, etc. and repair as necessary. Check the engine for leaks, cracks, etc. and repair as necessary. Check the engine for leaks, cracks, etc. and repair as necessary.

50. Part I, Chapter IV.
 IV. Every 100th Flying Hours.
 Add item h

In this helicopter, the connecting valve unit, or the solenoid-operated valves of groups 1, 2, and 3, indicating fire-extinguishing compound to the lower front fuel tanks (1, 2, 3, 4, 5, 6) and lower rear tanks (7, 8) are temporarily out of order.

During fire detection group check and when fire occurs during flight, a fire warning light located on the flight instructor's control panel comes on, and indicating fire in these groups. The light on panel 1 (1, 2, 3, 4, 5, 6) located on the pilot's control panel and the light on panel 2 (7, 8) will not come on. Fire-extinguishing compound will not be sent to these groups either automatically or manually.

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58. Part I, Chapter IV.
Scheduled Maintenance
Operations.
Every 50±5 Flying
Hours.
Hydraulic System.

To prevent the filter element
from damage, the filters should
be screwed out and removed with
the help of special device
69515-10a which is included in
the tool kit.
Check the filter elements for
damages.
Replace the faulty filter
elements with new ones.

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Signs^② (number in circle) marked in this book
refer to step number of "ALTERATION" section.

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INTRODUCTION

The **Mu-6** transport helicopter (Figs 1, 2 and 3) designed by M.L. Mil is a rotary wing aircraft with a single five-bladed main rotor and an antitorque four-bladed tail rotor (used to counterbalance the driving torque of the main rotor and to ensure the helicopter directional control). The tail unit of the helicopter comprises an adjustable stabilizer and a fin beam with a fixed rudder.

The helicopter fuselage is an all-metal riveted semi-monocoque consisting of the nose and central parts, the tail boom, and the pylon.

To reduce the load imposed on the main rotor when airborne, the helicopter is furnished with a cantilever controllable wing that can be adjusted with the aid of a hydraulic mechanism to either of the two positions: the one used for powered flight and that employed when landing with the main rotor operating at autorotation duty.

The helicopter mounts two turbo-rotor engines **Il-25B** with free turbines.

To transmit torque from the free turbines of the engines to the main and tail rotors, fan, and other units, the helicopter is fitted with a transmission assembly including the main, intermediate, and tail gear boxes, the tail shafts, and the fan drive cardan shaft.

The helicopter-carried fan serves for cooling the main gear box, engine oil coolers, electric generators, and other units. The air delivered by the fan is also employed in the ventilating and cabin air heating systems of the helicopter.

The helicopter power plant, main gear box, and fan component units are mounted on top of the cargo compartment ceiling and protected with a common cowl.

Carried on board the helicopter are eleven bag fuel tanks arranged in containers under the floor and on top of the ceiling of the helicopter cargo compartment. Besides, two rigid external fuel tanks can be attached on both sides of the fuselage, if necessary.

The helicopter has a tricycle non-retractable landing gear supplied with oleo-pneumatic shock struts.

The fuselage nose part is occupied by the cabins accommodating the navigator, the pilots, the radio operator and flight engineer.

The fuselage central part represents a cargo compartment in which paratroopers, bulky cargoes, and materiel are airborne.

The helicopter crew cabins and the cargo compartment are provided with a ventilating and an air heating systems.

The helicopter controls include the hand and foot control systems, the combined collective pitch-throttle controls, the engine selector controls, the spring feel mechanism control system, and the main rotor brake controls.

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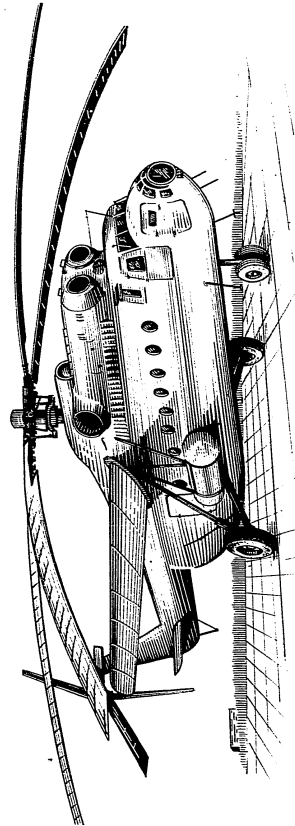


FIG. 1. HO4S HELICOPTER (FRONT VIEW).

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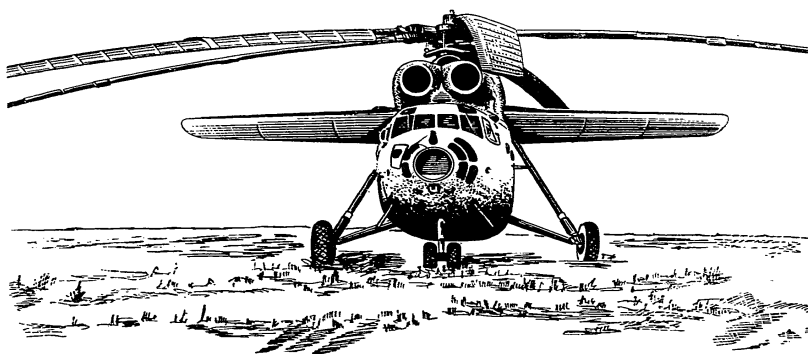


FIG. 3. MI-6 HELICOPTER (FRONT VIEW).

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Part One

AIRFRAME

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The airframe of the Mi-6 helicopter comprises the fuselage, the wing, the stabilizer, and the cowl (see Figs 1, 2, and 3). The airframe structural joints are shown in Fig. 4.

The airframe, in the main, is made of sheet duralumin Al6-T, reinforced duralumin B95, and, partially, elektron MAB. In a number of airframe units a wide use is made of the AK6 alloy stampings, the Al9 aluminum alloy and M15 magnesium alloy castings, and the Al6-T and B95 duralumin and B165-I elektron extrusions (some 120 types altogether). Some units and parts are manufactured of steel, grades 18XHMA, 30XICA, 1X18H9T, 40XHMA, BTI-I, 45, 25 and 20.

Frames, ribs, partitions, bulkheads, longerons, and stringers are fabricated from rolled Z-shaped section bars and pressed angles riveted to smooth walls. To add to rigidity of the sheets, they are provided with flutes and flanged holes.

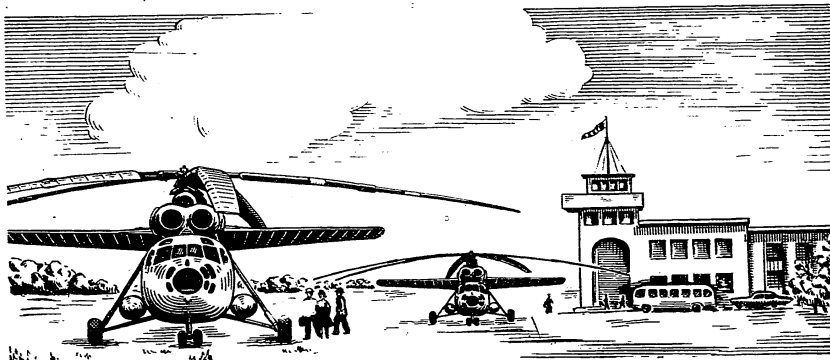
The outer and inner skins are made in sheet duralumin Al6-T and elektron MAB. All parts manufactured of sheet duralumin and extruded sections are anodized and painted, whereas those manufactured of elektron are protected with a special corrosion-preventive coating.

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Chapter I

FUSELAGE TRANSPORT AND TROOP-CARRYING EQUIPMENT

The Mm-6 helicopter fuselage is an all-metal semi-monocoque of a variable section.

The fuselage has three structural joints and consists of the following four parts: nose part, central part with the cargo compartment door panels and ramps, tail boom, and pylon.

The framings of all the four fuselage components comprise lateral members (frames) and longitudinal members (stringers and longerons). Together with the smooth stressed skin the framing forms a rigid structure.

The skin rivet joints employ, for the most part, lentil-head rivets.

1. FUSELAGE NOSE PART

The fuselage nose part (Fig.5) is the section comprising frames Nos 1 to 12. It is occupied by the cabins of the navigator, the pilots, and the radio operator and flight engineer. Frames Nos 6, 9, and 12 serve as bulkheads between these cabins.

Located under the floor of the pilots' cabin and the radio operator and flight engineer's cabin is a compartment containing various equipment.

The fuselage nose part component panels and production joints are shown in Fig.6. The framing of the nose part comprises twelve frames and a stringer assembly. The upper and side parts of the navigator and pilots' cabin framing are made up of stamped stiffeners fabricated from sheet duralumin. The outer skin of the fuselage nose part is formed by duralumin sheets held to the framing with flattened button-head rivets.

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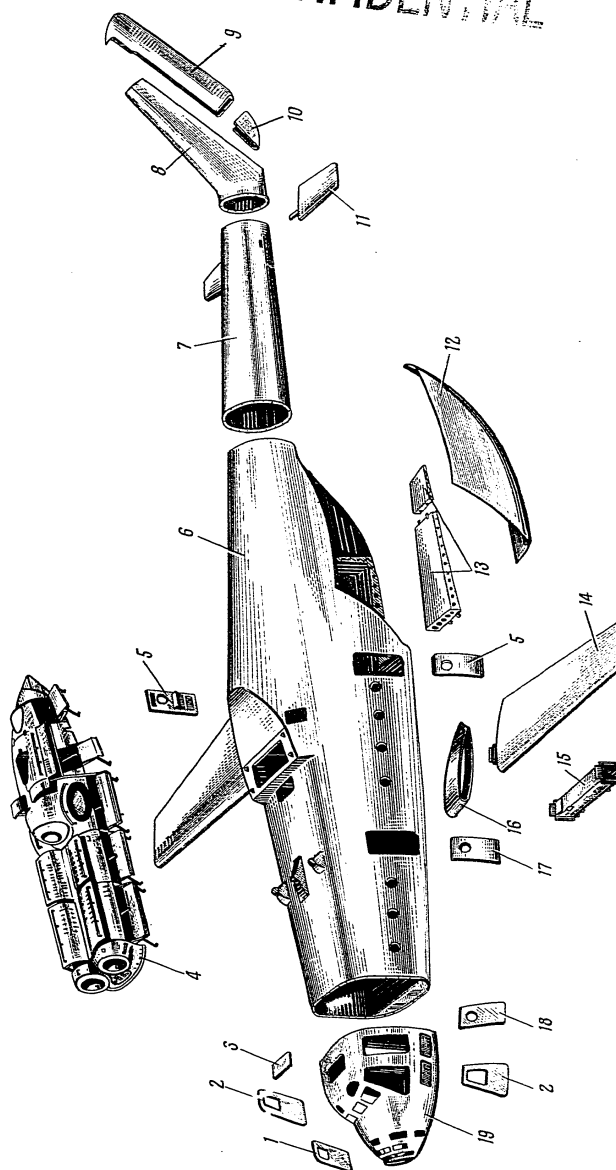
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FIG. 4. HELICOPTER AIRFRAME STRUCTURAL JOINTS
 1—navigator's cabin door; 2—pilot's cabin emergency exit door; 3—cover of hatch giving access to engines from crew's cabin; 4—rotor hub; 5—engine; 6—fuselage; 7—tail boom; 8—tail rotor; 9—tail rotor assembly; 10—removable fairing; 11—stabilizer; 12—cargo compartment front entrance door; 13—flight engineer and radio operator's cabin emergency exit door; 14—loading ramp; 15—wing cantilever; 16—center-plane beam; 17—wing fillet; 18—cargo compartment rear emergency exit door; 19—fuselage nose part.

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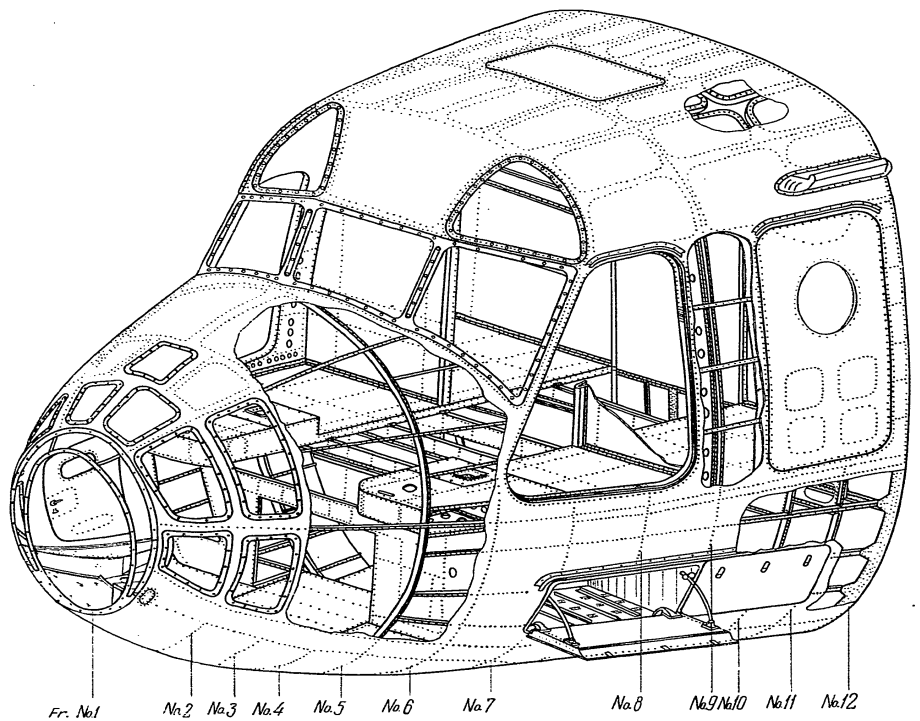


FIG. 5. FUSELAGE NOSE PART (15)
(pilots' cabin emergency exit door not shown).

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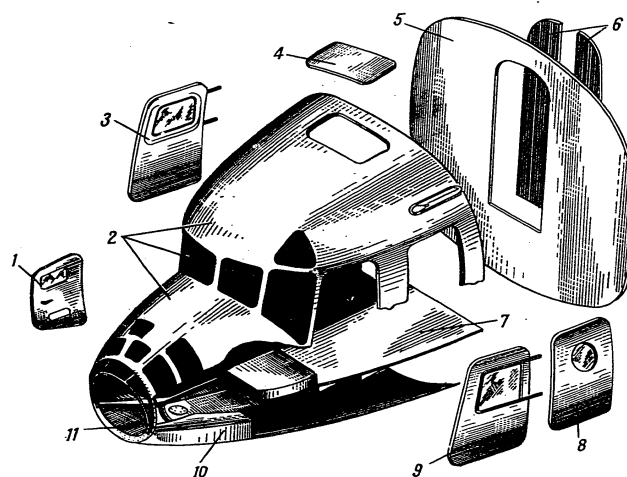


FIG. 6. FUSELAGE NOSE PART STRUCTURAL AND PRODUCTION JOINTS (15)
 1—navigator's cabin door; 2—skin and glass panels of navigator's, pilots', and radio operator and flight engineer's cabins; 3, 9—pilots' cabin emergency exit door; 4—cover of hatch giving access to engines from radio operator and flight engineer's cabin; 5—frame No. 12 of fuselage nose part; 6—crew's cabin door leaves; 7—pilots' cabin floor; 8—radio operator and flight engineer's cabin emergency exit door; 10—navigator's cabin floor; 11—windshield.

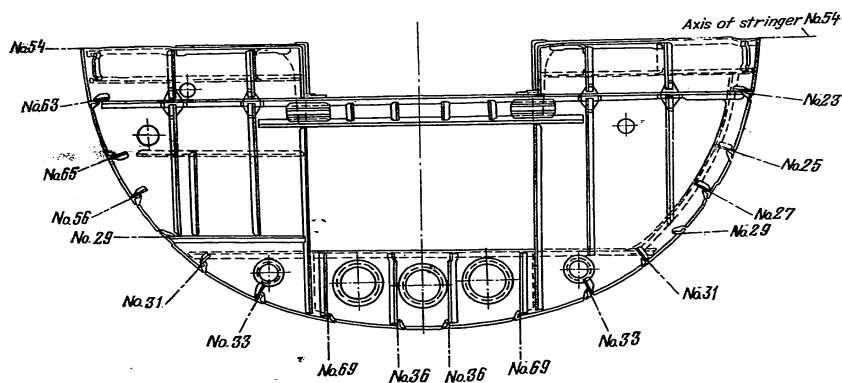


FIG. 7. FRAME NO. 6.

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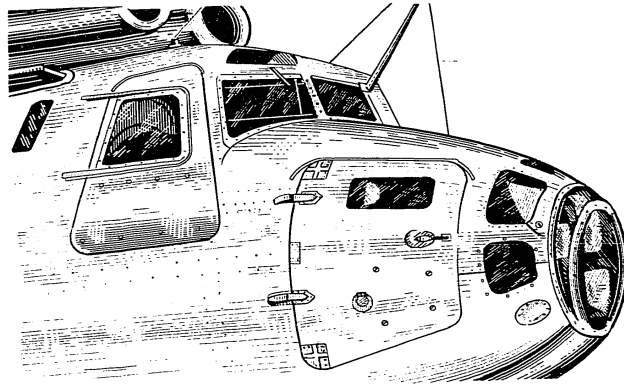


FIG. 8. GENERAL VIEW OF NAVIGATOR'S AND PILOTS' CABIN GLASS PANELS. (15)

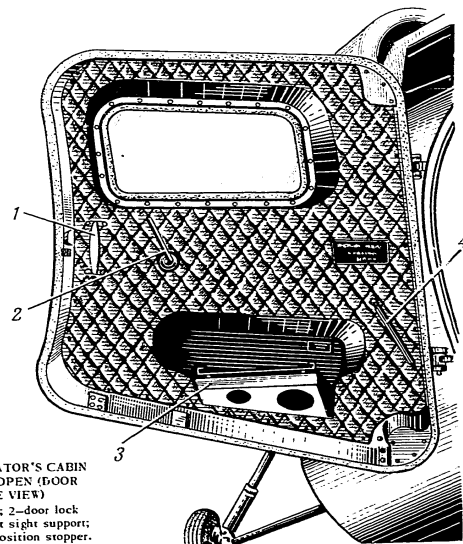


FIG. 9. NAVIGATOR'S CABIN DOOR WHEN OPEN (DOOR INSIDE VIEW)
1-door handle; 2-door lock handle; 3-drift sight support; 4-door open position stopper.

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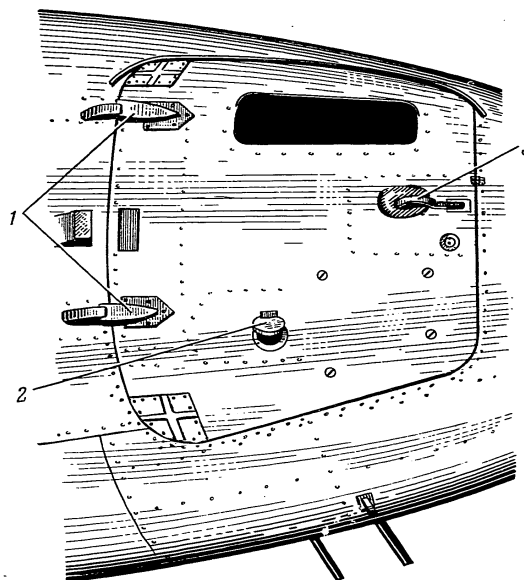


FIG. 10. NAVIGATOR'S CABIN DOOR WHEN CLOSED
(outside view)
1—door hinges; 2—drift sight hole hinged cover; 3—door handle.

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The navigator's cabin is located between frames Nos 1 and 6 (see Fig.5).

Construction of frame No.6 separating the navigator's cabin from cabin of the pilots is shown in Fig.7.

The navigator's cabin has windows glazed with organic glass 3 to 4 mm thick (Fig.8).

The windshield is formed by a flat silicate glass panel fitted with a film-type electric heater and providing good visibility in the flight direction from the navigator's cabin. The side glass panels ensure observation in the right- and left-hand directions, whereas the lower glass panel covers a field of view extending downward and forward. The cabin ceiling incorporates an electrically-heated silicate glass panel.

Located on the starboard side of the navigator's cabin is the entrance door (Figs 9 and 10) held in a closed position by a lock that can be opened with the aid of handles arranged inside and outside of the cabin. Besides, the door can be locked with a special key.

The upper part of the entrance door has a small glass panel, and its lower part, a stamped well with a hole for the drift sight; the hole is protected with a cover.

Emergency jettisoning of the door is accomplished with the aid of emergency jettison mechanism 15 (Fig.11) incorporating door jettison guns and mounted on the starboard at the navigator's cabin rear wall.

To jettison the door, pull back handle 9. As a result, springs 7 will force rods 6 out of the holes of hinges 1; at the same time, contact plates 3 and 5 will thrust against twin microswitches 4 thereby closing the electric circuit of the explosive charges of door jettison guns 10; due to action of the explosive charges, tappets 14 will push the door out.

The navigator's cabin floor (Fig.12) has longitudinal stressed beams made up of pressed duralumin angles riveted to the walls.

Together with the outer skin, the floor covering (plating) and beam webs form the right- and left-hand strong boxes.

Located on the navigator's cabin port side is a rack for navigation equipment. The horizontal panel of the rack incorporates an extension desk with drawer (Fig.13).

Riveted in parallel with the floor longitudinal axis are the guides carrying the navigator's seat (Fig.14). When swung back, the seat is accommodated under the pilots' cabin floor; when moved forward to the working position, it is locked with a pin. A special mechanism makes it possible to turn the seat to the right or to the left. The seat is equipped with safety harness.

The threshold of the pilots' cabin and the walls in the navigator's cabin are upholstered in soft material thus substituting for the back-rest of the navigator's seat. The navigator's cabin directly communicates with the pilots' one.

The pilots' cabin is located between frames Nos 6 and 9. Construction of standard type frames is illustrated in Figs 15 and 16.

The glazing of the cabin canopy front (see Fig.8) includes four glass panels: two 4-mm organic glass windshields and two side panels manufactured of special silicate glass and fitted with an electric heater.

The silicate glass panels are held in frames cast of magnesium alloy M15 and riveted to the cabin framing. The glass panel frame casting prevents the glass from getting cracked or damaged during all possible twists of the canopy riveted structure.

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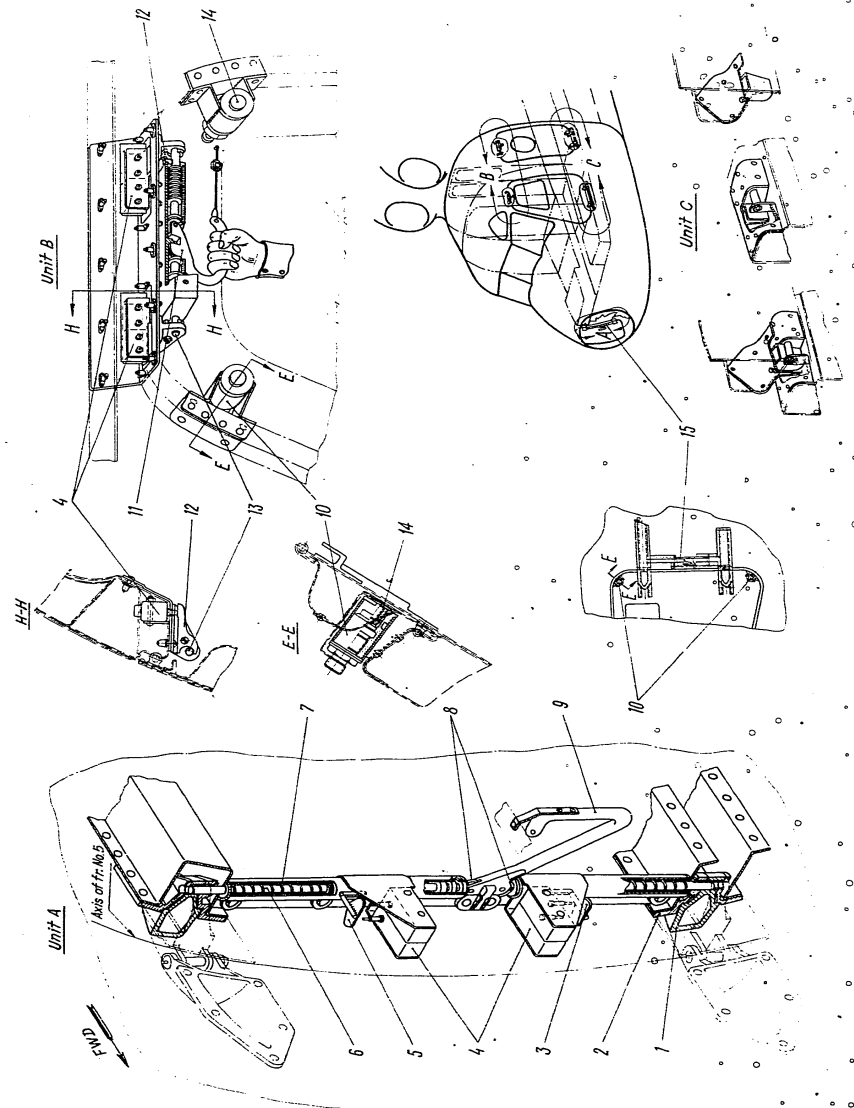


FIG. 11. CREW'S CABIN DOOR EMERGENCY EJECTION MECHANISM (A802A). 1—door hinge; 2—bracket; 3—lower contact plate; 4—miniature switches A802A; 5—upper contact plate; 6—rod; 7—spring; 8—rollers; 9—navigator's cabin door emergency ejection handle; 10—door ejection gun; 11—pilots' and flight engineer's cabin door emergency ejection handle; 12—lever; 13—rod; 14—ratchet; 15—door emergency ejection mechanism.

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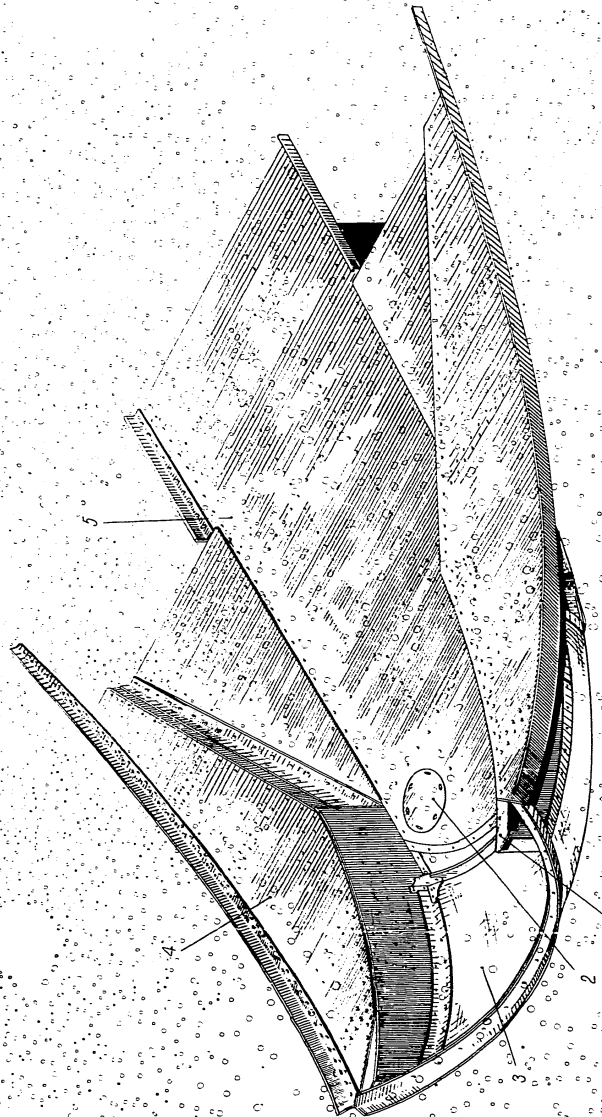


FIG. 12. NAVIGATOR'S CABIN FLOOR (15)
1—stressed beam; 2—production hole door; 3—lower glass panel; 4—threshold; 5—floor covering.

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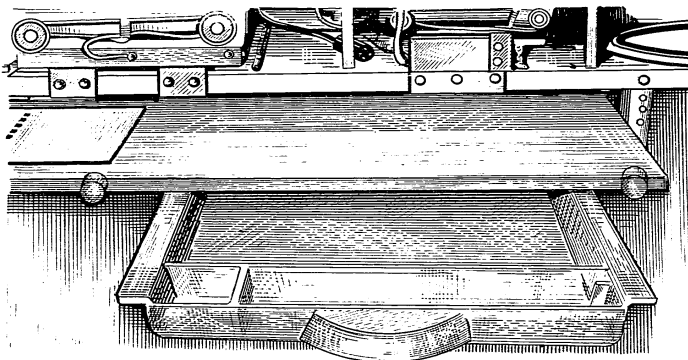


FIG. 13. NAVIGATOR'S WORKING DESK AND DRAWER IN EXTENDED POSITION.

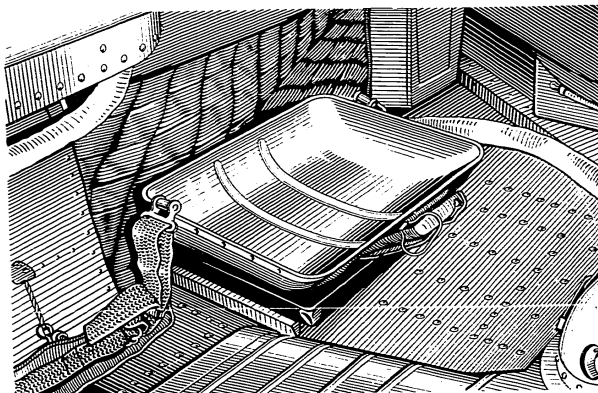


FIG. 14. NAVIGATOR'S SEAT.

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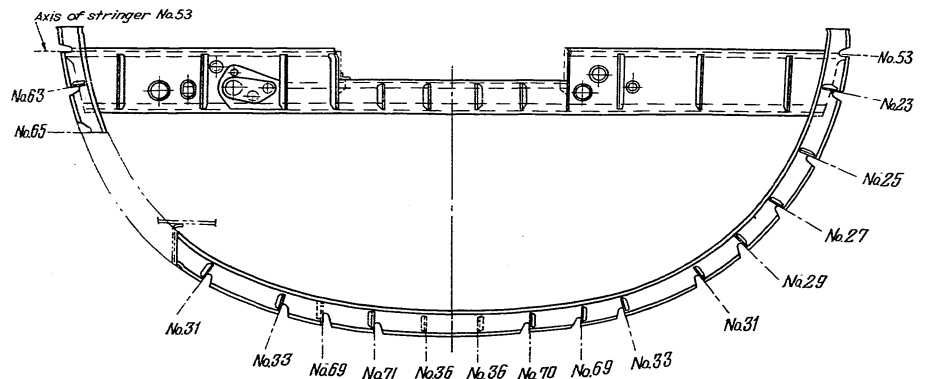


FIG. 15. FRAME NO.8.

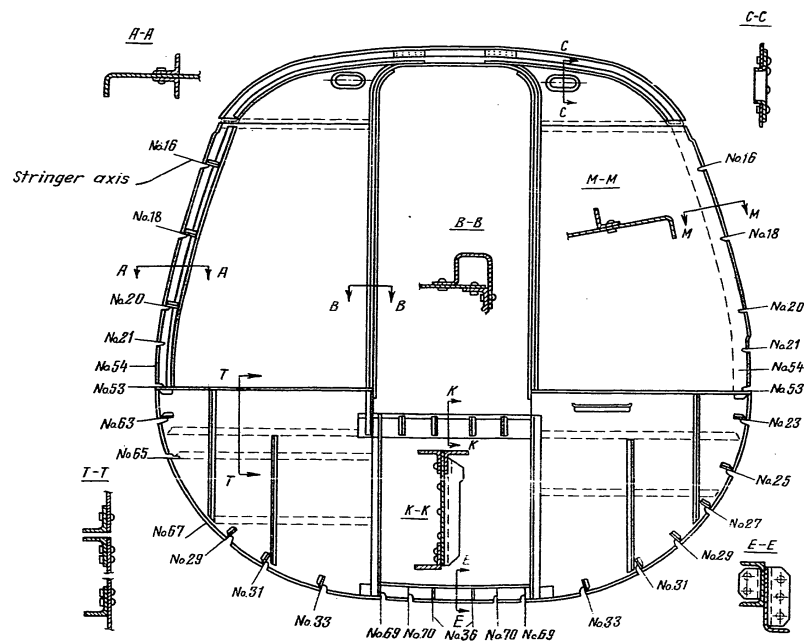


FIG. 16. FRAME NO.9.

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The pilots' emergency exit doors are located on the starboard and port sides of the cabin (Fig.17). The doors have no hinges and are locked in their apertures with the lower retainers and the upper pins of the door emergency jettison mechanism which is constructionally similar to that installed on the navigator's cabin door (see Fig.11).

Arranged in the upper part of each door are sliding blisters (Fig.18) used to give a larger field of view to the pilot when taking off and landing. The blisters are fixed in the closed position with a special retainer.

Together with the frame lower portions, the longitudinal stressed beams arranged in fours on the helicopter starboard and port sides form the framework of the pilots' and radio operator and flight engineer's cabin floor (Fig.19).

Mounted on the floor are the foot and hand control assemblies and units, as well as the collective pitch-throttle control levers. Located in the floor covering between frames Nos 7 to 9 on the port and starboard sides are hatches giving access to the control units while in service.

In the centre of the pilots' and radio operator and flight engineer's cabins (beginning from the entrance door on frame No.12), there is a passageway 700 mm wide whose floor runs on a level 105 mm lower than that of the pilots' cabin floor. The passageway floor is formed by three detachable panels made of plywood 5 mm thick and reinforced with a sheet of duralumin on top.

The front part of the pilots' cabin ends in a bulkhead (web of frame No.6) with a doorway leading to the navigator's cabin. Mounted on the bulkhead are the instrument panels of the right and left pilots.

The cabin of the pilots communicates with that of the radio operator and flight engineer through a doorway made in frame No.9 (the rear wall of the pilots' cabin) and measuring the pilots' cabin in height and 700 mm in width (see Fig.16). Attached to the vertical side strips of the doorway on the side of the radio operator and flight engineer's cabin are three collapsible footsteps leading through the upper hatch to the engines.

The pilots' seats, similar in design, are installed on the cabin floor to the right and left of the doorway.

The pilot's seat (Fig.20) comprises a pan cast of magnesium alloy and a back-rest. The seat pan is secured to the rod of the actuating cylinder built in the bracket.

The upholstered back-rest is made of a bent tube with a magnesium alloy sheet riveted to it. The back-rest can be set for any required angle through being rotated about the axle inserted into the pan eyes.

The seat bracket is attached to the stressed members of the pilot's cabin floor with four bolts.

The seat is provided with soft armrests, safety belts, and shoulder harness. It can be adjusted for both height and the back-rest tilt angle by means of a hydraulic control valve mounted on the back-rest rear (see Chapter X dealing with the helicopter hydraulic system).

The radio operator and flight engineer's cabin occupies the space between frames Nos 9 and 12 (see Fig.5).

The radio operator is seated on the right-hand side (if viewed in the direction of flight). Installed near the starboard side of the helicopter between the webs of frames Nos 9 and 12 is the radio operator's table with hinged side covers protecting the radio equipment arranged under the table panel.

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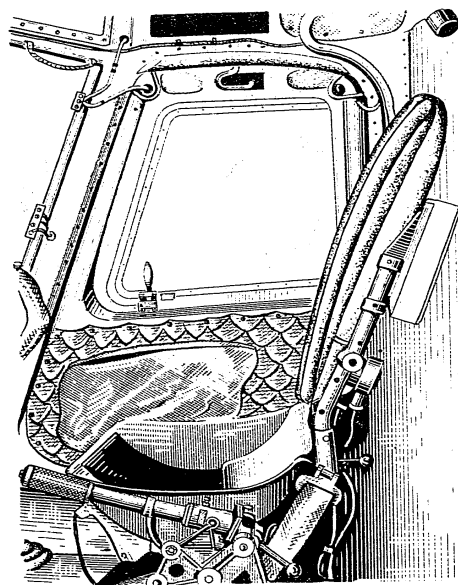


FIG. 17. CO-PILOT'S EMERGENCY EXIT DOOR (cabin interior view). (16) (29)

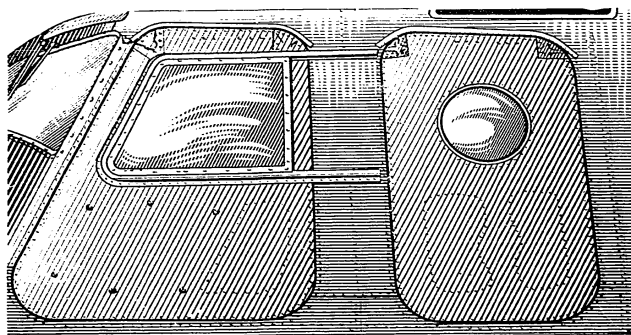


FIG. 18. SLIDING BLISTER MOUNTED IN PILOT'S EMERGENCY EXIT DOOR (outside view).

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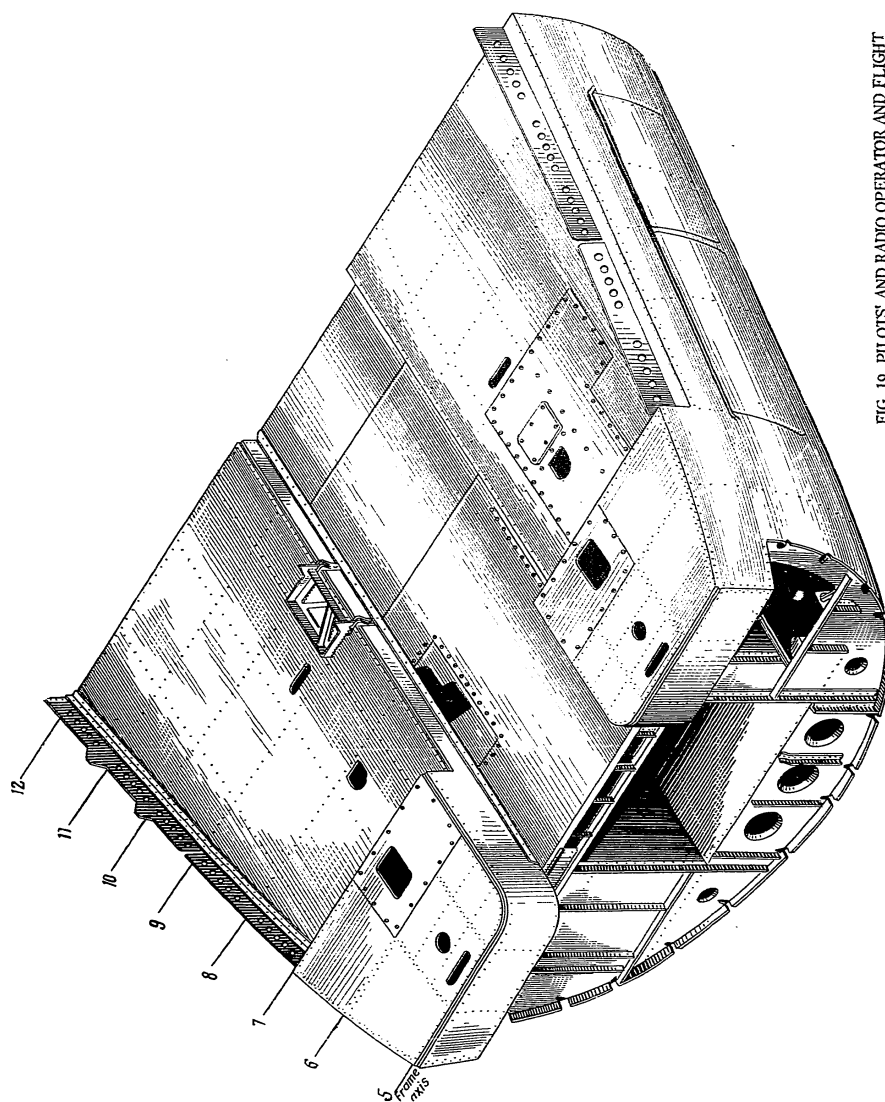


FIG. 19. PILOTS' AND RADIO OPERATOR AND FLIGHT
ENGINEER'S CABIN FLOOR.

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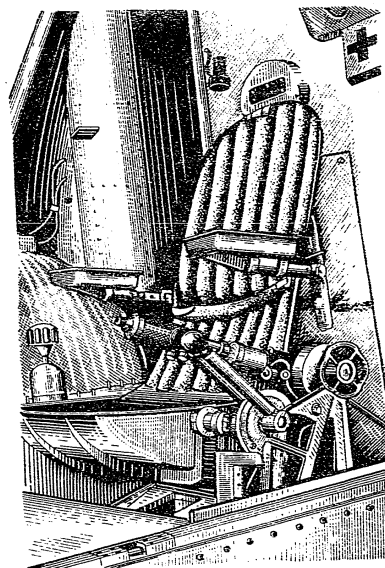


FIG. 20. PILOT'S SEAT. (25)

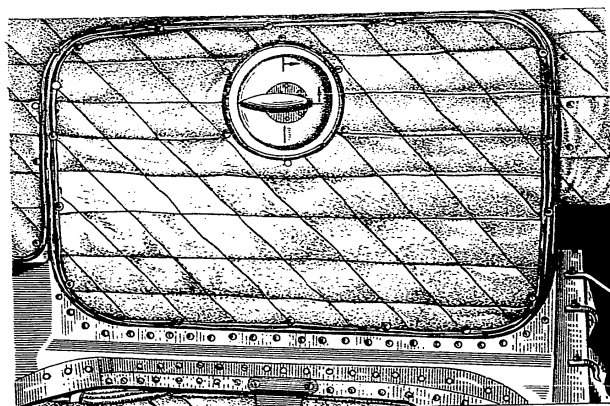


FIG. 21. HATCH GIVING ACCESS TO ENGINES FROM CREW'S CABIN
(hatch cover closed).

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Besides, the rear right-hand side of frame No.9 carries a rack mounting some other items of radio equipment. Built in the horizontal panel of the rack is an extension table with drawer. Right above the radio operator's table, between frames Nos 10 and 11, provision is made for a rectangular window glazed with organic glass 3 mm thick.

The ceiling of the radio operator and flight engineer's cabin is formed by stamped stiffeners held to the outer skin with lentil-head rivets. Cut in the ceiling along the cabin axis is a hatch giving access to the helicopter power plant (Figs 21 and 22); the hatch is normally protected with a sealed cover.

The flight engineer's place is to the left (if viewed in the direction of flight). Arranged at the port side on the rear of frame No.9 web are the flight engineer's control and instrument panels.

The port side of the cabin has an emergency exit door (see Fig.4) with a door jettison mechanism similar to that employed in the pilots' cabin. The door mounts an organic glass blister opening inside the cabin and the flight engineer's collapsible table (Fig.23).

Frame No.12 (Fig.24) that constitutes the cabin rear wall is reinforced with laterally and longitudinally arranged section bars.

A doorway 700 mm wide with a two-leaf door is made in this frame to provide communication between the fuselage nose part cabins and the cargo compartment. The door leaves are glazed in their upper portion thus making it possible for the radio operator and flight engineer to keep an eye on the airborne cargo while in flight.

The door has handles attached on both sides of it and a retainer mounted in the door upper lintel on the crew's cabin side. Upholstered back-rests of the radio operator and flight engineer's seats are secured to the web of frame No.12.

The helicopter flight engineer's seat is mounted on the web of frame No.12 (Fig.25). When in the working position, the seat pan rests upon its supporting bracket that thrusts against the floor. The bracket is kinematically linked to the web of frame No.12.

When rendered loose, the pan is forced upwards to bear against the web through action of springs arranged in the seat hinges (Fig.26); as a result, free access to the emergency exit door is gained.

The radio operator's seat (Fig.27) is constructionally identical with the flight engineer's one.

The space formed under the floor of the pilots' and radio operator and flight engineer's cabins is utilized to accommodate various equipment and to lay the heating system lines.

Provided outboard on the port side of the helicopter at a level running below the pilots' cabin floor are two wells housing the containers of four storage batteries (Fig.29); the containers are installed on, and locked in, special guides. The wells are protected from outside with two hinged covers locked with three lever-operated locks.

Owing to the presence of special braces, the covers can be adjusted to a horizontal position to be used as supports on which the containers with the storage batteries can be placed during installation or removal. The well upper covering is supplied with hatches giving access to the flight control units. The hatch covers are secured in place with screws and self-locking nuts.

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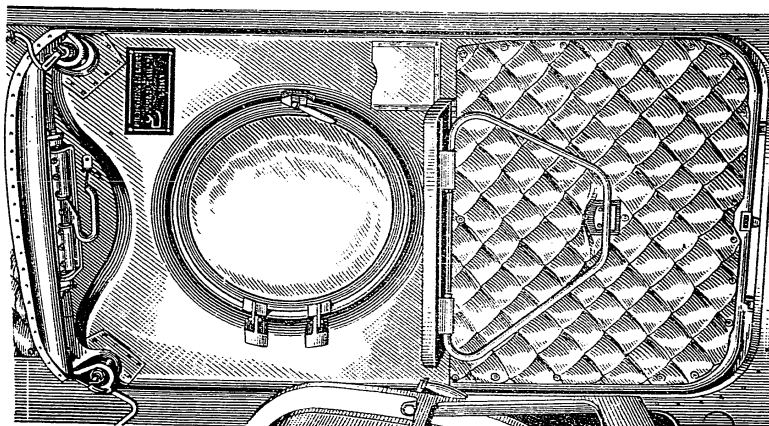


FIG. 23. EMERGENCY EXIT DOOR OF
FLIGHT ENGINEER AND RADIO OPER-
TOR'S CABIN WITH COLLAPSIBLE
TABLE AND INSIDE-OPENING BLISTER
(cabin inside view).

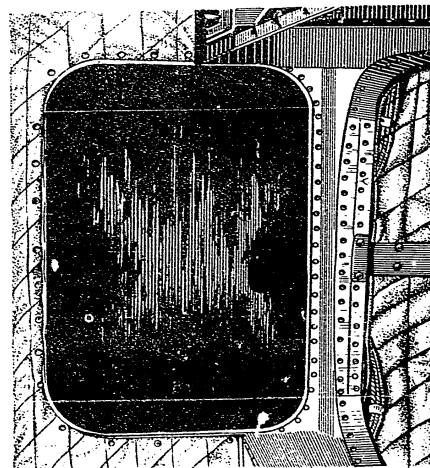


FIG. 22. HATCH GIVING ACCESS TO
ENGINES FROM CREW'S CABIN WITH
HATCH COVER OPEN
(cabin inside view).

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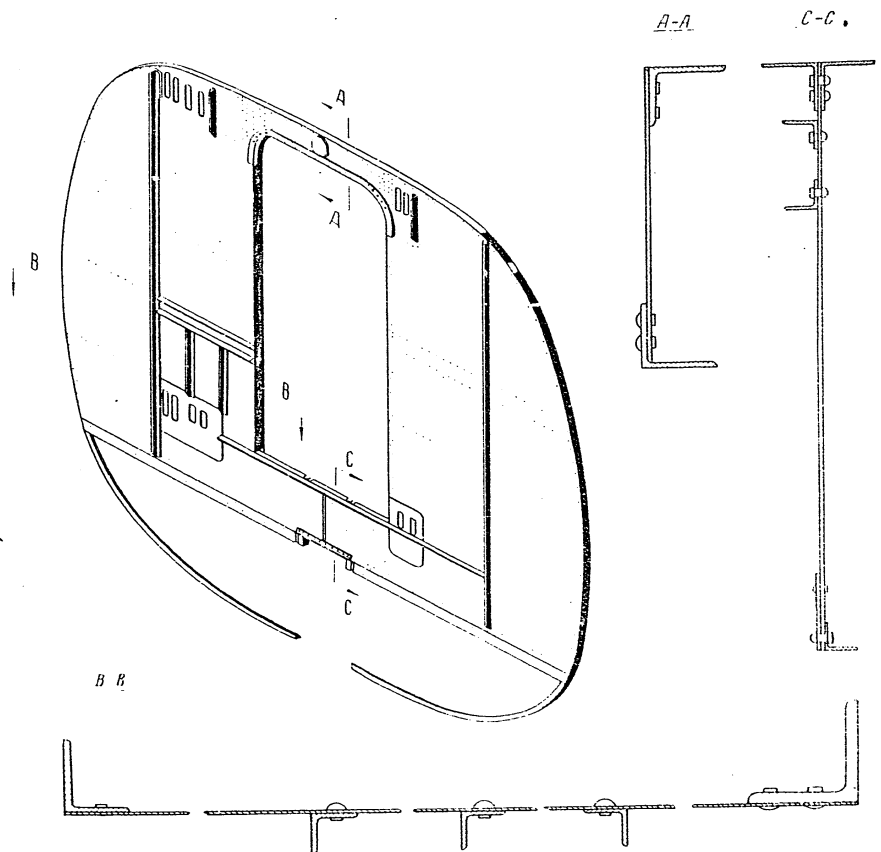


FIG. 24. FUSELAGE NOSE PART FRAME NO.12
(viewed in flight direction).

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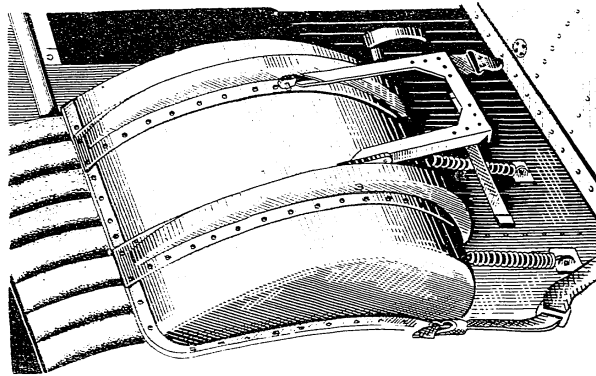


FIG. 26. FLIGHT ENGINEER'S SEAT IN SWUNG-BACK POSITION. (25)

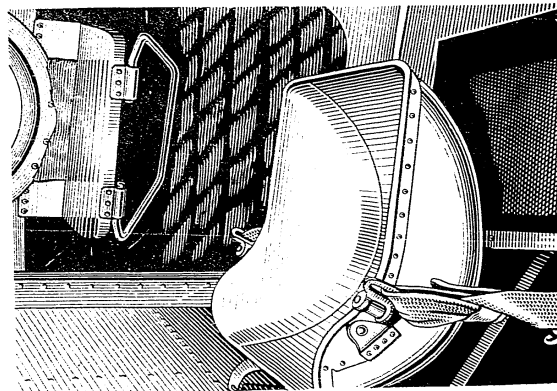


FIG. 25. FLIGHT ENGINEER'S SEAT IN WORKING POSITION.

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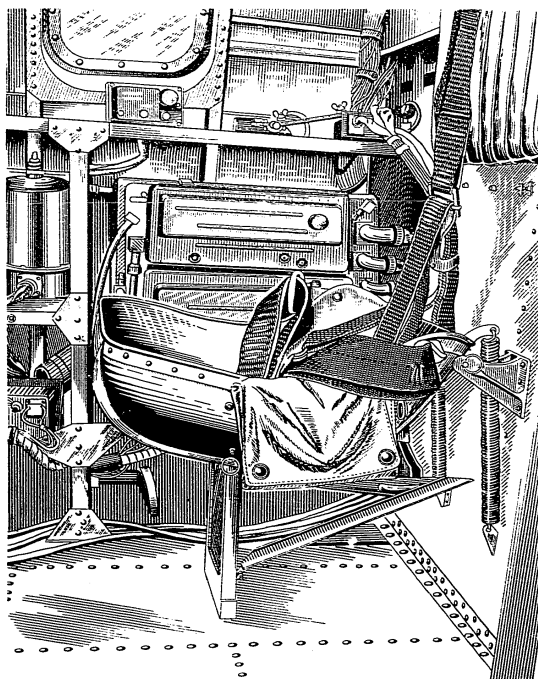


FIG. 27. RADIO OPERATOR'S SEAT (25)

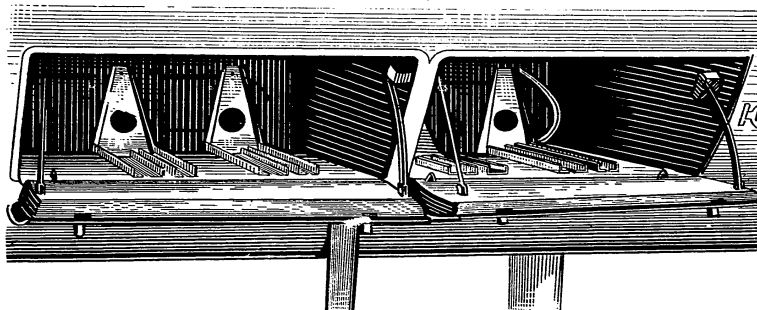


FIG. 28. WELLS FOR STORAGE BATTERY CONTAINERS WITH COVERS OPEN (25)

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Provided in the skin lower portion extending forward beyond frame No.12 is an axial cut for the landing gear nose strut normally protected with an outer fairing made up of two halves and secured with screws and self-locking nuts.

The fuselage nose part is assembled as a separate section to be jointed along the contour with the fuselage central part by means of ninety-five 30XICA steel coupling bolts 8 mm in diameter.

2 FUSELAGE CENTRAL PART

The fuselage central part (Fig.29) occupies the space between frame No.1 (secured to frame No.12 of the fuselage nose part) and frame No.42.

The cargo compartment is located between frames Nos 1 and 26, whereas the tail part of the fuselage with the portion joined to the tail boom is girdled by frames Nos 26 to 42. In the latter part of the fuselage the frames form the cargo compartment rear hatch.

Located above the ceiling of the cargo compartment are the engine compartment (between frames Nos 1 and 14) and the gear box compartment (between frames Nos 14 and 18).

The space between frames Nos 18 and 19 is occupied by the centre-plane beam of the wing.

The superstructure above the ceiling of the cargo compartment accommodates the containers of three bag fuel tanks installed between frames Nos 19 and 26. Arranged under the ceiling between frames Nos 26 and 31 are side panels resting upon a slant frame which mounts the cargo compartment door panel attachment fittings (Fig.30).

The stressed framing of the fuselage central part is made up of frames, stringers, the stress-carrying floor of the cargo compartment, and the cut-out edging strips.

The frame lower portions constitute an integral part of the lateral framing of the stress-carrying floor.

The frame upper portions located above the cargo compartment ceiling are components of the fuselage superstructure.

All the fuselage central part components are made of sheet duralumin and sheet elektron, the Al6-T and B95 duralumin and, partially, the BM65-I elektron extrusions.

The cargo compartment has the following dimensions:

- (a) length - 11,725 mm;
- (b) height - 2085 mm as measured at frame No.2,
2024 mm as measured at frame No.5,
2595 mm as measured at frames Nos 17 to 22,
2645 mm as measured at frame No.26 (maximum height);
- (c) width - 2660 mm as measured at frame No.2,
2840 mm as measured at frames Nos 14, 18, and 22,
2920 mm as measured at frames Nos 23 to 26.

As measured at former frames the cargo compartment width reaches 3014 mm.

A dimensional drawing of the cargo compartment is given in Book I of the Description (see Fig.9).

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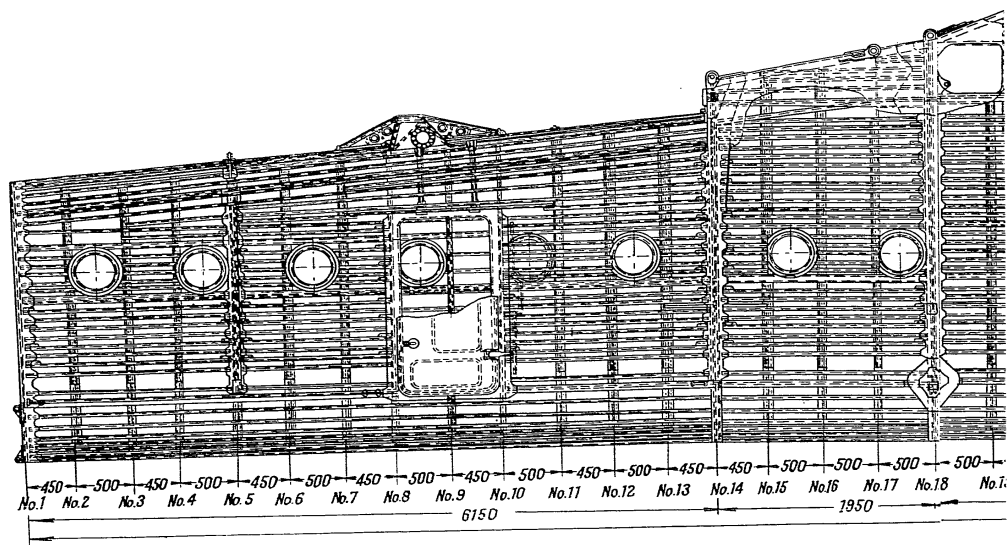


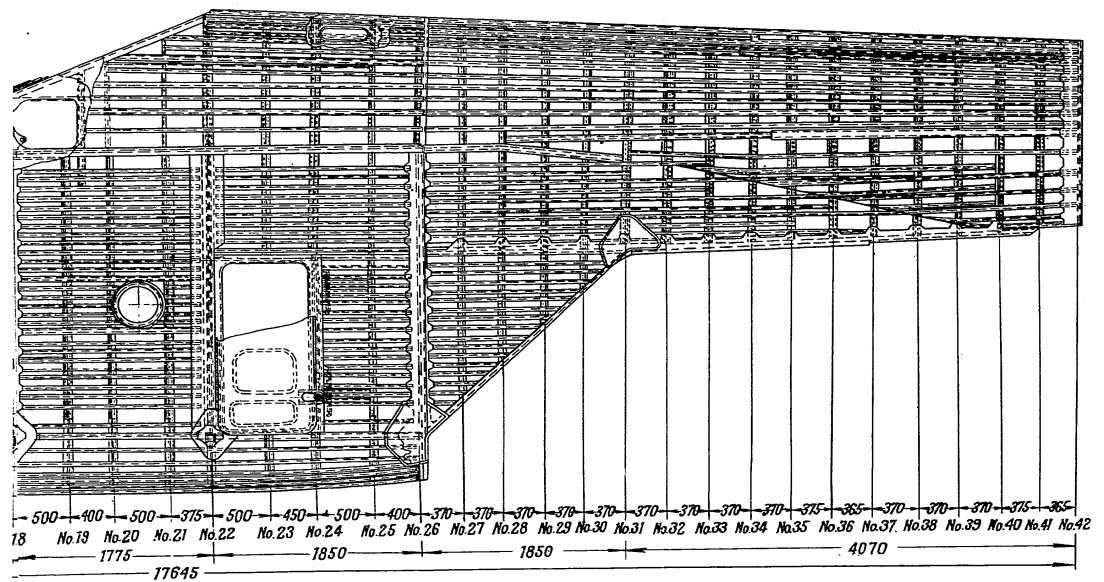
FIG. 29. FUSELAGE C

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RELAGE CENTRAL PART FRAMING.

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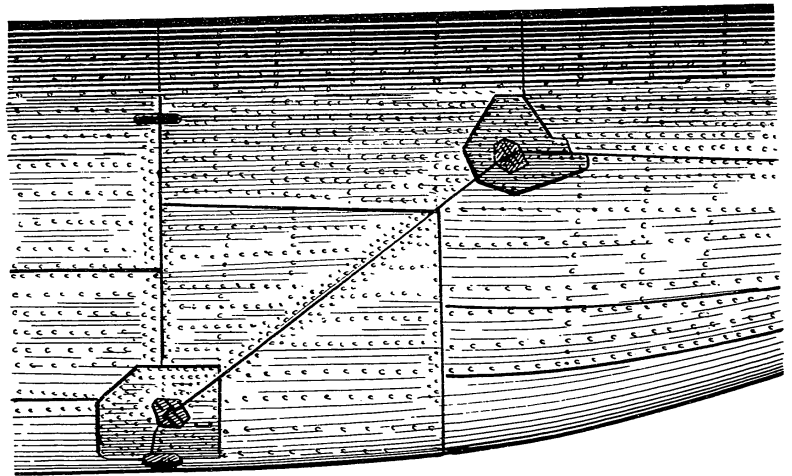


FIG. 30. ATTACHMENT UNITS OF CARGO COMPARTMENT DOOR PANELS.

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FRAMES

The maximum slipstream loads are taken by reinforced frames Nos 1, 5, 8, 10, 14, 18, 22, 26, 31, 36, 41, and 42.

All reinforced frames are I-beams formed by a web with duralumin extrusions riveted to it. The rest of the frames are conventional type, fabricated from rolled Z-shaped sections of sheet duralumin $\Delta I6A-T \Delta I1.5$, $\Delta I1.2$, and $\Delta I1.0$.

Frames Nos 19 to 41 consist of side members and upper portions that constitute the lateral framing of the superstructure arranged above the fuselage ceiling.

Construction of some principal type frames is shown in Figs 31 to 37.

Frame No.1 is formed by a duralumin angle section. Riveted to one cap of the section are the stringer fittings; the other cap is a flange with holes drilled along its contour for bolts jointing the cap with the mating flange of frame No.12 of the fuselage nose part.

In its top portion, frame No.5 (Fig.31) represents an I-shaped cross-beam riveted into which are three two-sided fittings stamped of alloy AK6. Installed on these fittings from outside (above the ceiling) are steel units for the adjustable struts of the engine mount.

The web of the cross-beam of frame No.5 is manufactured of duralumin $\Delta I6A-T \Delta I2$ and edged with section bars B95THK2-8I along the contour. The side members of the frame also represent webs made of duralumin $\Delta I6A-T \Delta I2$ and edged with sections $\Delta I6 \Pi p100-II$ along the contour, too. Attached to the sections with the aid of bands and fittings are the fuselage skin side panels and the stringers. The side members of the frame are 93 mm wide.

Construction of standard (conventional type) frame No.7 is illustrated in Fig.32.

Frame No.14 (Fig.33) is the main stress-carrying frame to whose upper units the front units of the gear box mount are attached.

The frame side members are 180 mm wide. A frame side member consists of a $\Delta I6A-T \Delta I2$ duralumin web edged with $\Delta I6-T \Pi K2-64$ duralumin extrusions along the inner contour, and with $\Delta I6-T \Pi K-4$ duralumin extrusions, along the outer contour (the one adjacent to the skin). The side panels of the skin and the stringers are secured to the extrusions with use made of fittings.

The frame cross-beam of an I-shaped section is located above the ceiling. It is made up of a web manufactured of duralumin $\Delta I6A-T \Delta I1.2$ and edged with T-shaped section $\Delta I6-T \Pi K3-94$ in the top portion, and with angle sections $\Delta I6-T \Pi K-4$ in the bottom one.

Frame No.18 (Fig.34) is the second strongest frame among all the helicopter stress-carrying frames. The edges of its upper I-shaped cross-beam have the stressed attachment fittings of the gear box mount rear brace struts and those of the wing centre-plane beam (see Fig.51). The web of the I-beam is fabricated from sheet duralumin $\Delta I6A-T \Delta I1.2$ and reinforced with vertical strut extrusions $\Delta I6-T \Pi p102-7$ installed at close intervals.

Arranged at the ceiling level in line with the lower flange of the beam are attachment fittings of the landing gear shock strut. Inside the cargo compartment, a stressed lug to mount the external sling is secured to these fittings.

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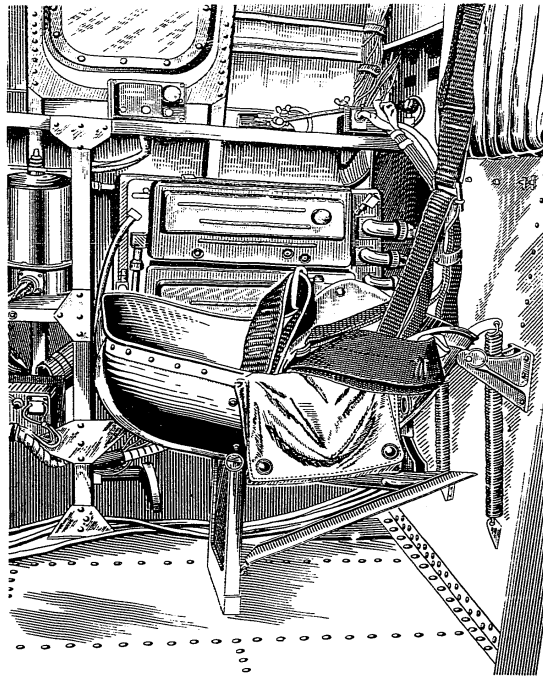


FIG. 27. RADIO OPERATOR'S SEAT (25)

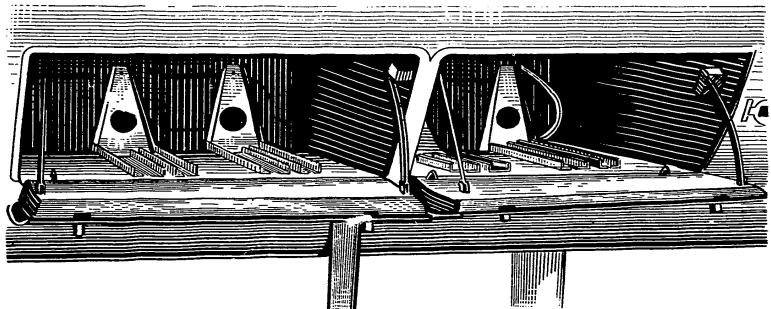


FIG. 28. WELLS FOR STORAGE BATTERY CONTAINERS WITH COVERS OPEN (25)

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Provided in the skin lower portion extending forward beyond frame No.12 is an axial cut for the landing gear nose strut normally protected with an outer fairing made up of two halves and secured with screws and self-locking nuts.

The fuselage nose part is assembled as a separate section to be jointed along the contour with the fuselage central part by means of ninety-five 30XICA steel coupling bolts 8 mm in diameter.

2. FUSELAGE CENTRAL PART

The fuselage central part (Fig.29) occupies the space between frame No.1 (secured to frame No.12 of the fuselage nose part) and frame No.42.

The cargo compartment is located between frames Nos 1 and 26, whereas the tail part of the fuselage with the portion joined to the tail boom is girdled by frames Nos 26 to 42. In the latter part of the fuselage the frames form the cargo compartment rear hatch.

Located above the ceiling of the cargo compartment are the engine compartment (between frames Nos 1 and 14) and the gear box compartment (between frames Nos 14 and 18).

The space between frames Nos 18 and 19 is occupied by the centre-plane beam of the wing.

The superstructure above the ceiling of the cargo compartment accommodates the containers of three bag fuel tanks installed between frames Nos 19 and 26. Arranged under the ceiling between frames Nos 26 and 31 are side panels resting upon a slant frame which mounts the cargo compartment door panel attachment fittings (Fig.30).

The stressed framing of the fuselage central part is made up of frames, stringers, the stress-carrying floor of the cargo compartment, and the cut-out edging strips.

The frame lower portions constitute an integral part of the lateral framing of the stress-carrying floor.

The frame upper portions located above the cargo compartment ceiling are components of the fuselage superstructure.

All the fuselage central part components are made of sheet duralumin and sheet elektron, the Al6-T and B95 duralumin and, partially, the BM65-I elektron extrusions.

The cargo compartment has the following dimensions:

- (a) length - 11,725 mm;
- (b) height - 2085 mm as measured at frame No.2,
2024 mm as measured at frame No.5,
2595 mm as measured at frames Nos 17 to 22,
2645 mm as measured at frame No.26 (maximum height);
- (c) width - 2660 mm as measured at frame No.2,
2840 mm as measured at frames Nos 14, 18, and 22,
2920 mm as measured at frames Nos 23 to 26.

As measured at former frames the cargo compartment width reaches 3014 mm.

A dimensional drawing of the cargo compartment is given in Book I of the Description (see Fig.9).

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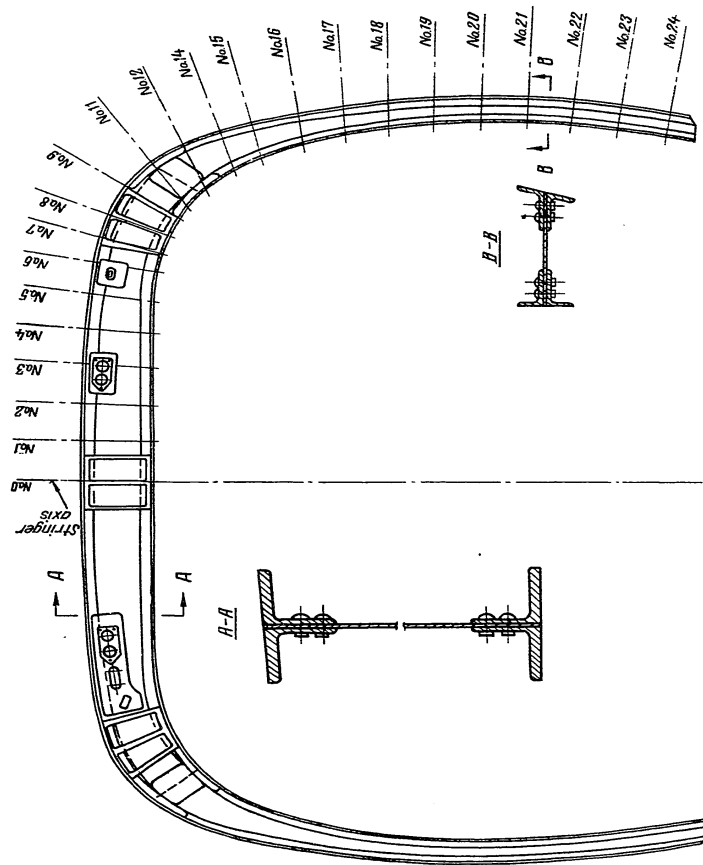


FIG. 31. FRAME NO. 5 (STRESSED).

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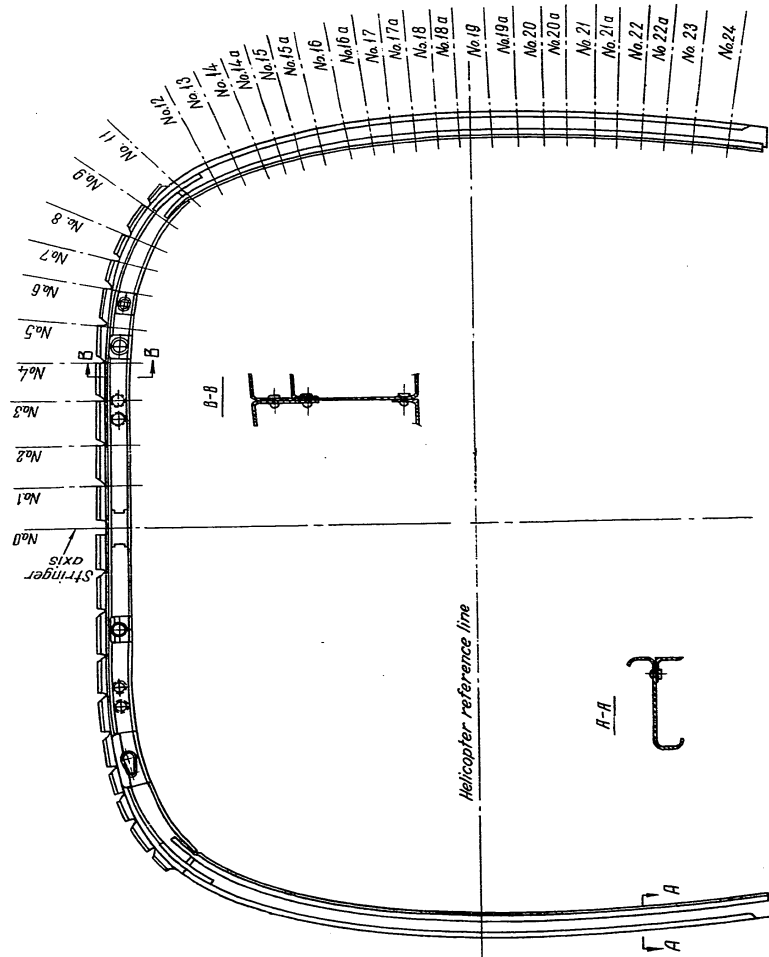


FIG. 32. FRAME NO. 7
(standard conventional type).

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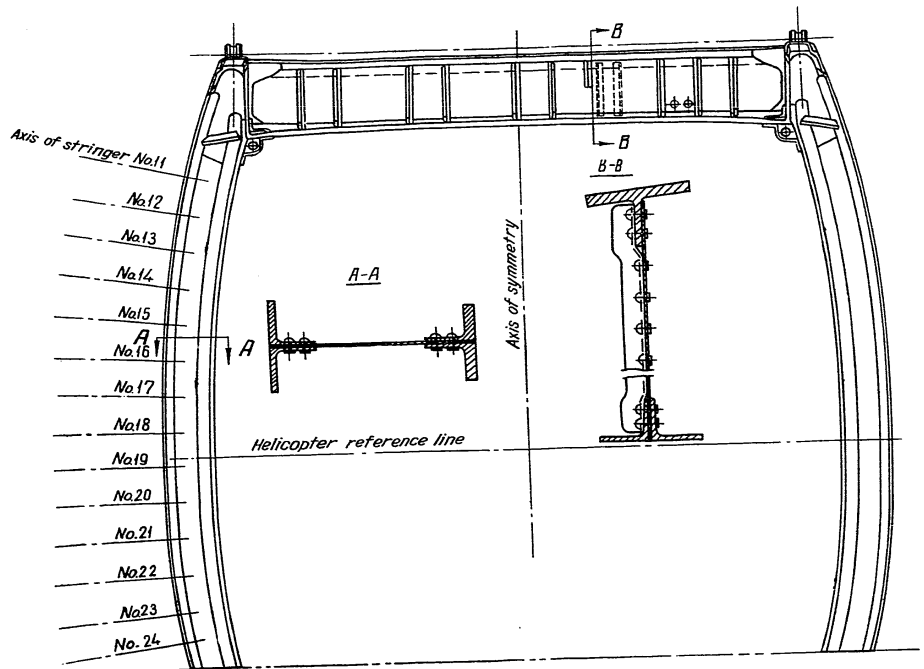


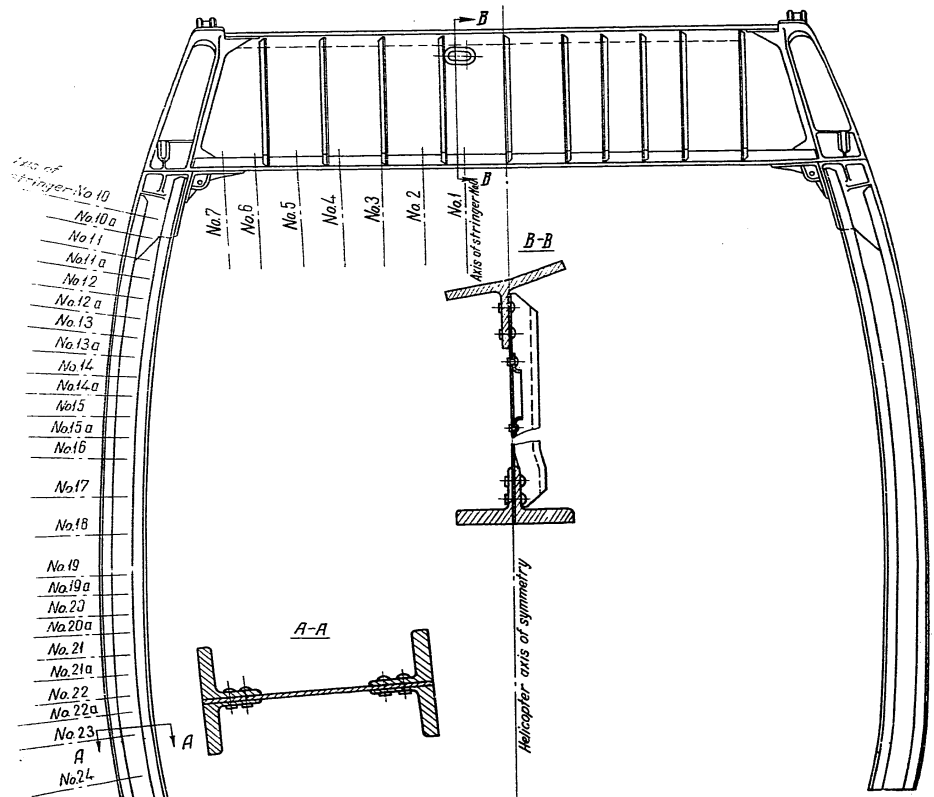
FIG. 33. FRAME NO. 14 (STRESSED) WITH GEAR BOX MOUNT ATTACHMENT UNITS.

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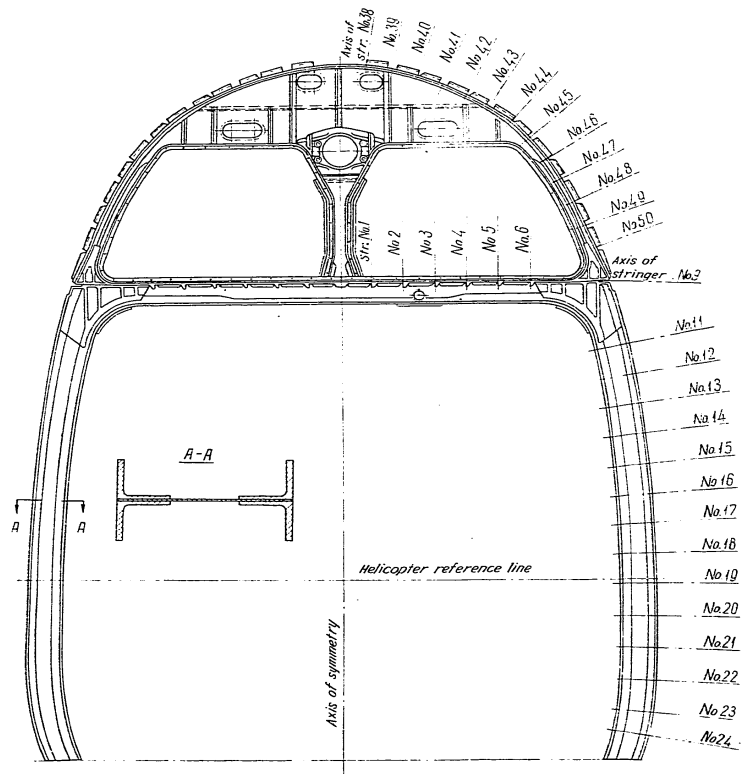


FIG. 35. FRAME NO. 22 (STRESSED) WITH SUPERSTRUCTURE FOR FUEL TANK CONTAINERS AND TAIL SHAFT SUPPORT.

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The I-shaped side members of the frame are 178 mm wide, being formed by a web made of sheet duralumin Д16А-Т13 and edged along its inner contour with duralumin extrusions Д16-Т Пп111-20 and along its outer contour, with duralumin extrusions Д16-Т ПК2-64. Secured to the frame at the joint between the frame side members and the stress-carrying floor are AK6 alloy stamped fittings mounting the attachment fittings of the L.G. axle shafts.

Fastened to the outer flanges of the side members are the skin side panels with the stringer assembly.

Frame No.22 (Fig.35) is also stressed. The bottom of the frame side members mounts the attachment fittings of the L.G. brace struts.

The I-shaped frame side members are 180 mm wide and comprise a Д16А-Т Д1.8 duralumin web edged with duralumin extrusions Д16-Т ПК301-12 along its inner and outer contours.

The frame superstructure separates the containers of the lateral fuel tanks from those of the longitudinal fuel tanks and carries the attachment unit of the tail shaft support.

Frame No.26 (Fig.36) is the last one in the cargo compartment frame assembly. The I-shaped frame side members are 140 mm wide, being formed by the Д16А-Т Д1.8 duralumin webs edged with duralumin extrusions Д16-Т ПК2-42 along their inner and outer contours.

The lower portion of the side members attaches the stress-bearing fittings of the joint to the slant frame. The frame superstructure backs up the longitudinal fuel tank containers and carries the attachment unit of the tail shaft support.

Frame No.31 (Fig.37) is made up of a superstructure with the attachment unit of the tail shaft support incorporated and lower arms secured with stressed fittings to the slant frame. The frame web is made of duralumin Д16А-Т Д1.5, edged with duralumin extrusions, and reinforced with an assembly of vertical and slant extruded angles.

STRINGER ASSEMBLY

The stringer assembly of the fuselage central part is symmetrically arranged with respect to the longitudinal vertical plane of the helicopter. The stringers are designated with ordinal numbers, beginning from the vertical axis above (see Figs 31, 36, and 76).

Stringers Nos 10 to 25 of the cargo compartment side panels are spaced at intervals of 90 to 100 mm, the main stringers of the Д16-Т Пп102-35, Д16-Т Пп102-5, and Д16-Т Пп102-8 duralumin section bars alternating with the auxiliary stringers of the БМ65-1 Пп100-53 электрон section bars (see Fig.36).

Stringers Nos 1 to 5 on the ceiling of the cargo compartment are made of the БМ65-1 Пп102-5 электрон section bars, and Nos 6 to 14, of the Д16-Т Пп102-5 duralumin section bars, both spaced at 160-mm intervals from one another.

Stringers Nos 26 to 36 inclusive located under the covering of the stress-carrying floor are manufactured of the Д16-Т Пп102-35 duralumin sections and arranged at 180 to 200-mm intervals from one another.

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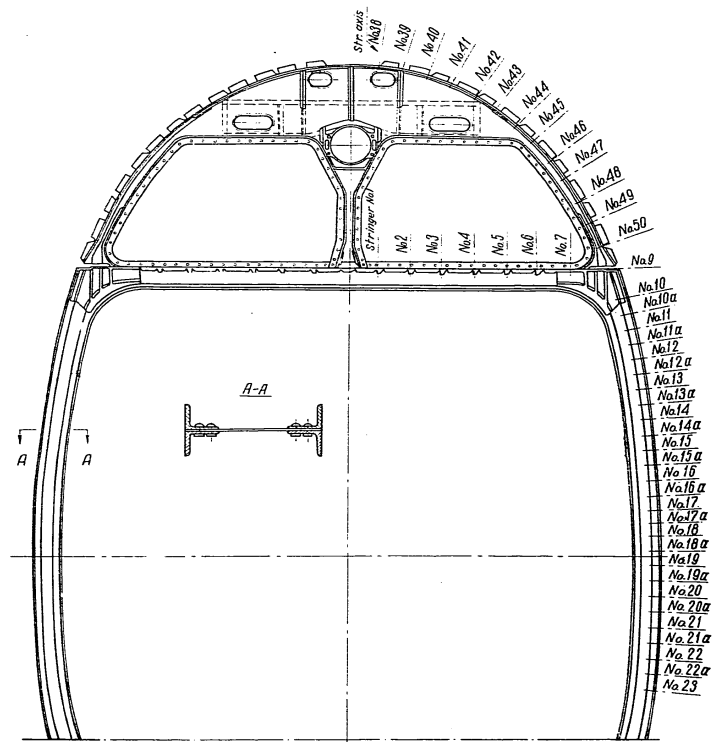


FIG. 36. FRAME NO. 26 (STRESSED) WITH SUPERSTRUCTURE FOR FUEL TANK CONTAINERS AND TAIL SHAFT SUPPORT.

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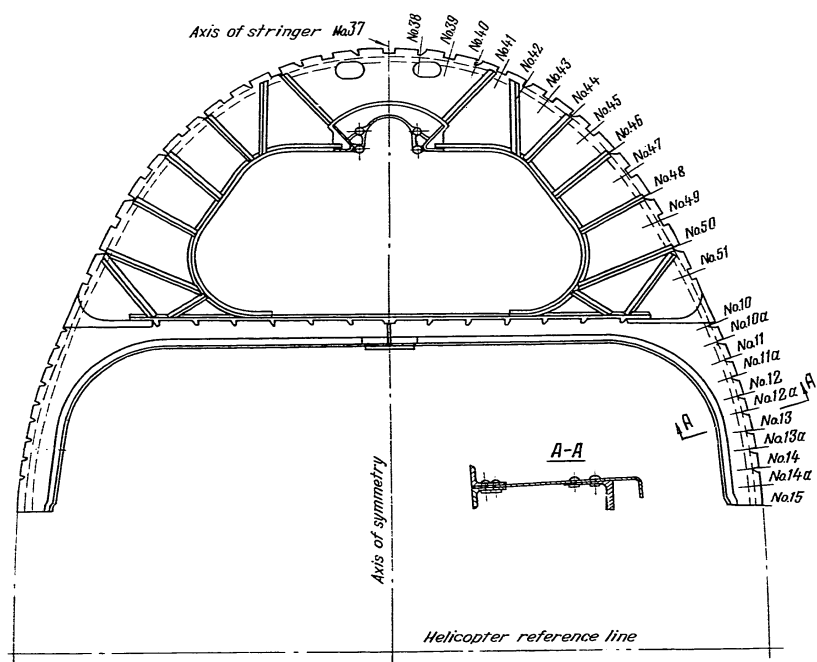


FIG. 37. FRAME NO. 31 (STRESSED) WITH TAIL SHAFT SUPPORT.

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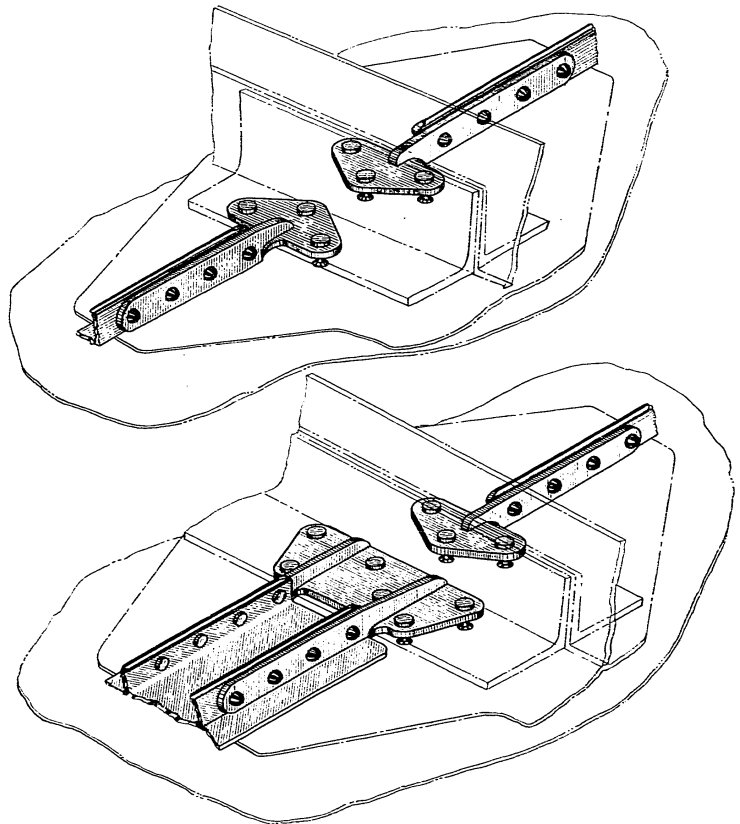


FIG. 38. STANDARD STRINGER-TO-STRESSED FRAMES ATTACHMENT FITTINGS.

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Above the ceiling of the cargo compartment, the stringers have an ordinal numbering from No.37 to No.51 inclusive. The spacing of the tail boom stringers agrees with that of the fuselage stringers on the hoop of frame No.42.

The tail boom stringers are made of ~~II-shaped~~ ^{and 216-T H610-8} duralumin extrusions II6-T HK647-2, II6-T HK647-3 ^{and 216-T H610-8} alternating with extruded duralumin angle bars II6-T HPII2-5. The stringers are secured to frames with knees and angle plates, being jointed on frames Nos 5, 14, 18, 22, 26, and 42 through use of various fittings the most typical of which are shown in Fig.38.

Used as stringers on the stretch between frame No.22 and frame No.31 are the II6-T HPI02-35 duralumin extrusions installed at intervals of 160 to 170 mm. Above the cargo compartment ceiling the inner stringers are arranged in the vicinity of the fuel tank containers between frames Nos 19 to 26, which ensures rigidity of the skin of the containers taking up an excessive pressure of kerosene in the bag fuel tanks of up to 0.2 kg/sq.cm.

Installed along the frame side member contours on the stretch between frames Nos 31 and 38 are spacer stringers made of extruded magnesium angle bars and providing for rigidity of the fuselage structure at compression loads.

FUSELAGE SKIN

The skin protecting the fuselage central part (see Fig.39) is composed of duralumin sheets II6A-T II.0, II6A-T II.2, II6A-T II.5, II6A-T II.8, II6A-T II.2.0, II6A-T II.2.5, 338AH-I and 338AH-2 and includes the skin of the side panels and superstructure and the covering of the stress-carrying floor.

The side panel skin sheets employ butt joints accomplished on frames Nos 5, 14, 18, 22, and 26 with the aid of bands, and lap joints (on the superstructures of frames Nos 22, 26, 31, and 36).

The skin sheets are butt- and lap-jointed laterally with use made of two- or three-row riveted seams done with flattened buttonhead rivets 4 to 5 mm in diameter.

Butt and lap joints in the longitudinal direction employ, for the most part, a two-row riveted seam. The outer skin below the stress-carrying floor level is also secured with flattened buttonhead rivets.

The configuration and thickness of the outer skin sheets are diagrammatically shown in Fig.39. Thick II6A-T II.2.0 duralumin sheets are made use of between frames Nos 14 and 18, and the II6A-T II.2.5 sheets, between frames Nos 1 and 2 as the most stressed ones.

The sheets covering the stress-carrying floor are manufactured of corrugated duralumin 338AH with squares formed on its surface to increase friction.

INNER SKIN AND PANELS

On certain stretches the cargo compartment is provided with an inner skin. On the stretch from frame No.22 to frame No.31 the entire inner surface of the fuselage is covered with duralumin sheets II6A-T II.0.8. From the floor level up to the level of stringer No.19 (under the window line) the starboard and port sides of the cargo compartment are protected with safety skin of sheet elektron MAB II.0.8. The skin is provided with necessary inspection and maintenance hatches.

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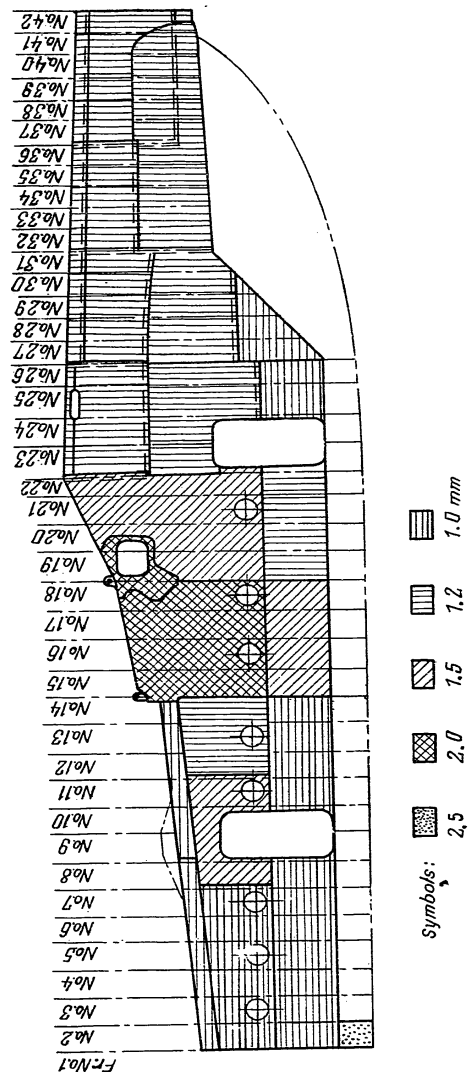


FIG. 39. OUTER SKIN OF FUSELAGE MIDDLE PART.

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Installed on the ceiling and some cargo compartment side stretches are easily detachable guard panels (Figs 40 and 41) protecting the supply lines of the power plant and hydraulic system, the control rods, etc. from accidental damage. For added rigidity purposes, the panels are provided with flutes, some of the panels being hinged to the ceiling and fixed with screw-type spring locks, the other being held in place with screws and self-locking nuts. To provide access to the pipeline durite connections, the panels have hatches with hinged covers retained with locks.

The rear web of frame No.12 of the fuselage nose part is also covered with guard panels from the cargo compartment side, thus preventing the control system bell cranks and rods against being accidentally damaged.

CARGO COMPARTMENT WINDOWS AND DOORS

The windows are arranged on both sides of the cargo compartment between stringers Nos 16 and 19. The cargo compartment starboard side has nine windows, and the port side, seven. Besides, there are windows in the two doors located on the port side, and in the door located on the starboard side.

The glass panels of the windows on the sides have the form of bulging spherical blisters, whereas those arranged in the doors are flat and round, being made of high-strength organic glass 3 mm thick.

The glass panels are installed into round frames cast of magnesium alloy MI5, fitted between the frames, and secured to the stringers (Fig.42). The panels are attached to the window frames with screws and semi-circular nuts and sealed along the contour with Y-20 tape and Y-20 cord.

The cargo compartment has three doors one of which is the entrance door, whereas the other two serve for leaving the helicopter in emergency cases. The doorways are 1635 mm high and 805 mm wide.

The front entrance door (Fig.43) located between frames Nos 8 and 10 on the port side can be locked with a key. The door handles are provided from both inside and outside. In a closed position the door is held by an additional latch locked from inside, whereas in an open position it is prevented from being closed by wind gusts through use of a stopper.

Constructionally, the door represents a stiffener stamped of a sheet of AI6A-T MI.5 duralumin reinforced with the AI6A-T MI.0 duralumin outer skin held in place by rivets. To edge the door, bulb-shaped extrusions are used.

The door is hung on two hinges, cast of magnesium alloy MI5, and equipped with a door jettison mechanism of a special design. The doorway is formed by a frame stamped of a duralumin sheet and riveted into the fuselage side panel framing.

The emergency exit doors (Fig.44) are symmetrically arranged on both sides of the cargo compartment between frames Nos 22 and 24. Their framework and doorway as well as door jettison mechanism are similar in design to those of the front (entrance) door. The rear doors can be opened only from inside the cargo compartment and are not equipped with the open-position stopper.

The door jettison mechanisms (Fig.45) furnished with door jettison guns 6 are built into the fuselage framework near the doorways, on the side of the cargo compartment door attachment.

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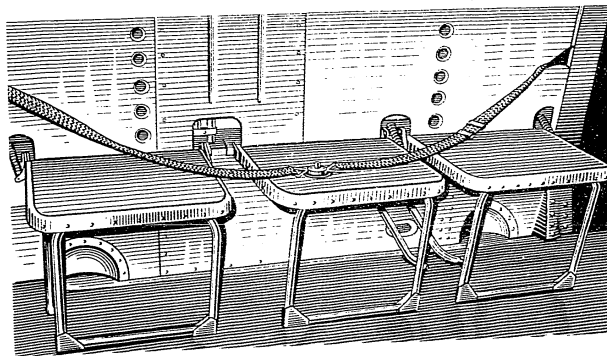


FIG. 40. CARGO COMPARTMENT INNER SIDE SKIN AND PARATROOPER SINGLE SEATS IN WORKING POSITION (25)

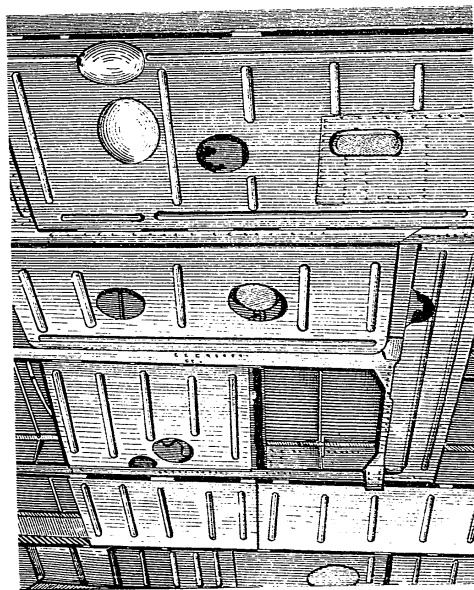


FIG. 41. ARRANGEMENT OF GUARD PANELS ON CARGO COMPARTMENT CEILING.

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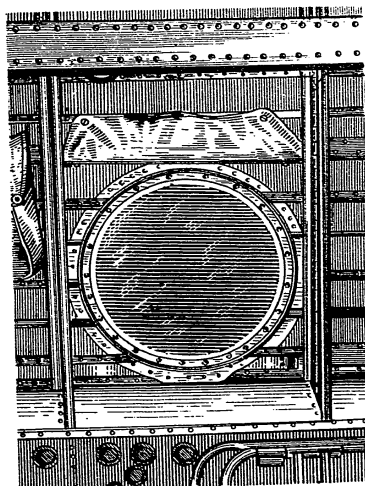


FIG. 42, WINDOW WITH BLIND (22)
(cargo compartment interior view).

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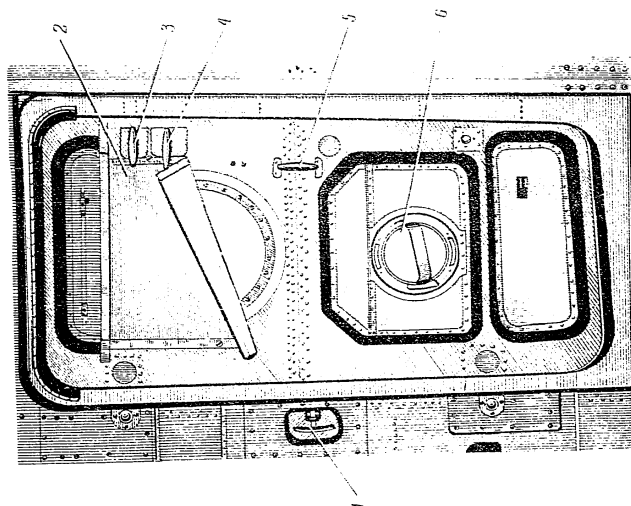


FIG. 41. REAR EMERGENCY EXIT DOOR OF CARGO COMPARTMENT PORT SIDE IN CLOSED POSITION (cabin interior view)
1-door emergency jettison handle; 2-blind; 3-lock handle; 4-safety lock handle; 5-handle; 6-cover of hatch for connection of air conditioner.

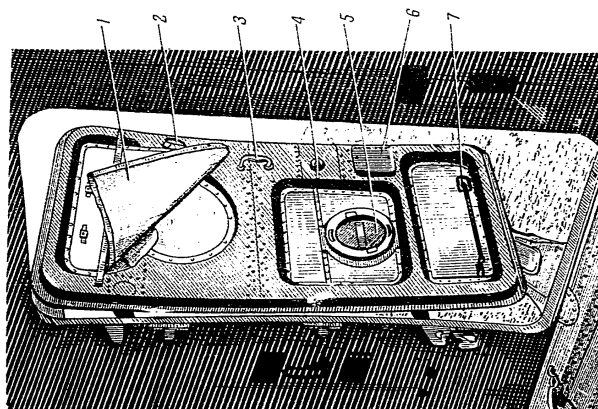


FIG. 43. CARGO COMPARTMENT FRONT ENTRANCE DOOR IN OPEN POSITION (cabin interior view)
1-blind; 2-safety lock handle; 3-handle; 4-main lock handle; 5-cover of hatch for connection of air conditioner; 6-lock; 7-door open position support.

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To increase reliability of the door jettison gun operation, twin-mounted microswitches 1 are connected into the explosive charge supply circuit. Both microswitches are depressed at a time by contact plates 2 and 11 attached to shanks 3.

To perform the door emergency jettisoning, withdraw the handle from the helicopter side and pull it back. This done, shanks 3, actuated by spiral springs 4, will make the contact plates depress microswitches 1 thus closing the circuit of the explosive charge of door jettison gun 5. As a result of the burst of the explosive charges, pistons 7 push out eye brackets 5 and jettison the door.

The opening of the front entrance door of the cargo compartment is indicated by a red light installed in the pilots' cabin and cut in by microswitch 8.

HATCHES

To provide access to, and convenience in maintenance of, the control system and transmission units, the gear boxes, the fuel, oil, and pneumatic lines, the hydraulic system, and other units, special hatches are made in the outer skin and the ceiling covering as well as in the covering of the stress-carrying floor. Arrangement of the hatches is illustrated in Fig. 46.

The hatch covers are either a stress-carrying type secured with self-locking screws or an easily detachable conventional type equipped with two lever locks or pin locks operated by a rotary handle (Figs 47, 48, 49, and 50).

The lock types and shapes of the hatches are as far standardized as possible. The hatches have stressed edging strips forming cut-out frames.

GEAR BOX COMPARTMENT

The gear box compartment girdled by frames Nos 14 to 18 and located just above the ceiling of the cargo compartment (Fig. 51) is essentially a strong stress-carrying mount arranged along an inclined line passing from frame No. 14 upwards to frame No. 18 and carrying four gear box mount attachment units.

The lateral and longitudinal framings of the gear box mount are composed of duralumin extruded sections $\Delta 16-T$ $\Delta pIII-35$. Along the contour the mount is edged with duralumin section $\Delta 16-T$ $\Delta K-394$. From outside the mount is covered with a sheet of duralumin $\Delta 16A-T$ $\Delta 2$.

The gear box mount attachment units are reinforced with plates of steel 30XICA placed under them. At frames Nos 15, 16, and 17 and the cross-beam of frame No. 14, the wide panels of the gear box mount are propped up by stress-carrying partitions.

Arranged symmetrically on the ceiling covering are two strong extrusions that generate from the gear box mount attachment unit on frame No. 14 and gradually decrease in section towards frame No. 17. In the region beyond frame No. 18 the mount is linked with a slant semi-oval panel whose contour is reinforced with a skin and a stringer assembly running along the superstructure (above the ceiling) towards the gear box compartment.

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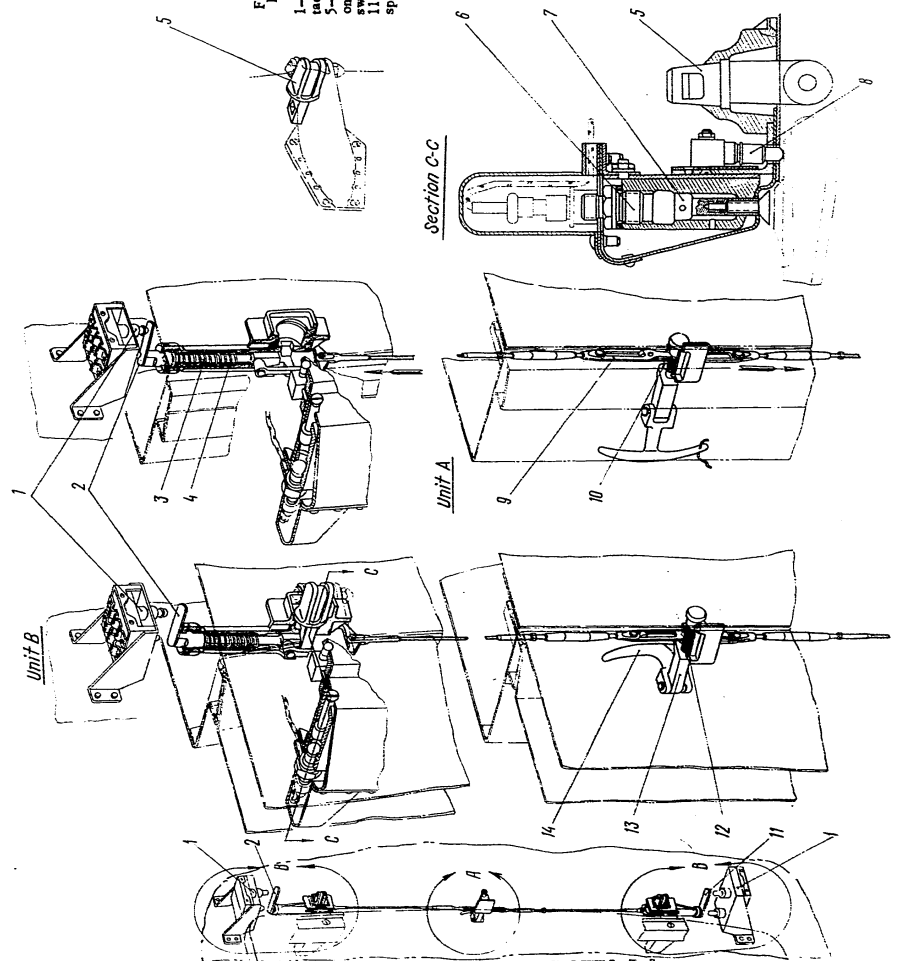
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FIG. 45. CARGO COMPARTMENT
DOOR EMERGENCY JETTISON
MECHANISM

1—microswitch AB02A; 2—upper con-
tact plate; 3—shank; 4—shank spring;
5—eye; 6—door jettison gun; 7—pist-
on; 8—door open-position micro-
switch AB12K; 9—shackle; 10—pin;
11—lower contact plate; 12—retainer
spring; 13—retainer; 14—door jett-
ison handle.



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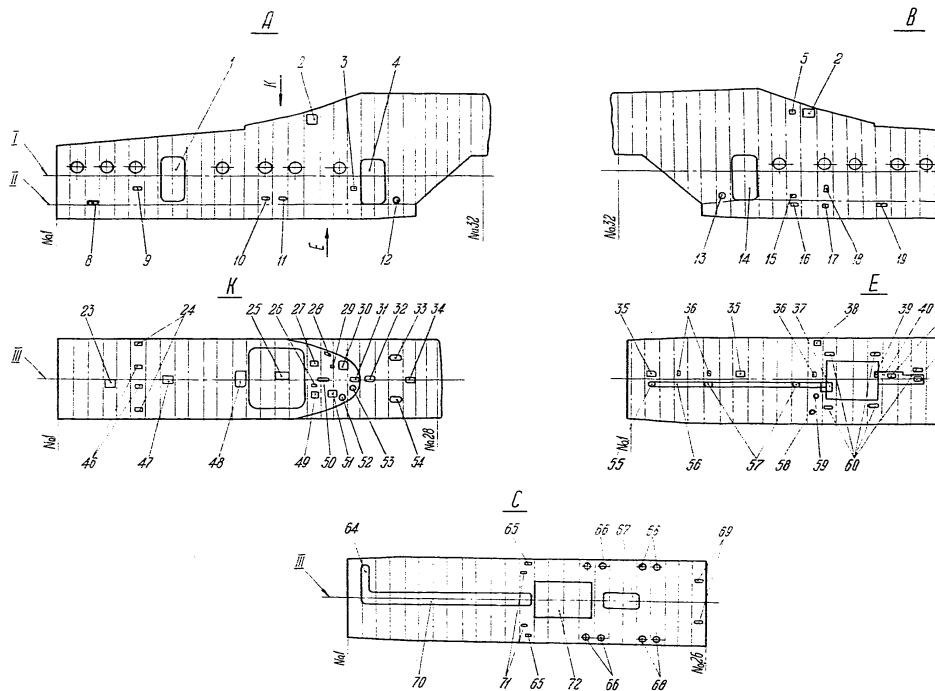


FIG. 46. DIAGRAM SHOWING ARRANGEMENT OF HATCHES AND HOLES ON FUSELAGE CENTRAL P. A—port side view B—starboard view C—view of stress-carrying floor upper covering K—view along arrow K E—along arrow E I—helicopter reference line II—stress-carrying floor line III—helicopter axis of symmetry 1—cargo compartment front doorway; 2—hole for wing centre-plane beam; 3—hatch for charging oxygen bottles; 4 a 14—cargo compartment rear doorways; 5—hole for installation of fuel transfer pipe; 6—hatch for dispensing fuel to consumers (with helicopter used as a flying tank); 7—fuel tank filler hatch; 8—hatch for ground electric power supply receptacle; 9—hatch for helicopter grounding bar; 10—hatch for pneumatic system ground supply panel; 11—hatch hydraulic system ground supply panel; 12 and 13—hatches for airborne materiel exhaust gas outlet; 15—hatch giving access to fuel drain cock; 16 and 19—hatches for installation of fuel vent and inert gas supply pipelines; 17—hatch for access to fuel drain cock; 18—hatch for filler of fuel tanks Nos 7 and 8; 20—hatch for installation of fuel pipeline for access to fuel drain cock; 21—hatch giving access to inboard refuelling unit; 22—hatch for inboard refuelling; 23—hatch for blade lifting pulley; 24 and 25—hatches giving access to cabin air heating lines; 25—slip ring assembly hatch; 26 and 28—holes for passing tail rotor control cables; 27 and 29—recesses for generators CFC-90/360; 28 way for passing fuel system pipelines; 29—hatchway for fuel pipes running from tank No.11; 30 and 32—hatches giving access to fittings installed in top portion of fuel tank No.11; 31, 32, and 34—tail shaft support inspection hatches; 33—hatch giving access to top plate of fuel tank No.10; 35 and 36—hatches giving access to fuel pipeline; 37 and 39—hatches giving access to fuel drain cocks with cargo compartment central hatch doors closed; 38—hatch giving access to angular velocity transmitter; 40, 43, 56, 64, and 70—detachable panels; 41, 55, and 57—hatches for access to pump drain cocks; 42—hatch providing access to fuel tank drain cock; 44—hydraulic system pipeline access hatch 45—hatch giving access to loading ramp control microswitches; 46—hatch for engine thermocouples; 47—hatch for inspection of engine rear support fastening bolts; 48—gear box compartment inspection hatch; 50—hatchway for tail shaft; 51—hatch for installation of fuel pipeline; 54—hatch giving access to top plate of fuel tank No.9; 58—hatch giving access to joint of cabin heating line connections; 59—hatch for installation of fuel pump drain cock; 60—hatch for installation of pneumatic system line; 61—hatch for installation of MP-11-500 receiver and inboard antenna; 62—hatch giving access to fuel pipeline connections; 63—hatch for connection of hydraulic system pipelines; 65, 66, and 68—hatchway hatches; 69—hatches for loading ramp actuating cylinders; 72—central hatch in stress-carrying floor.

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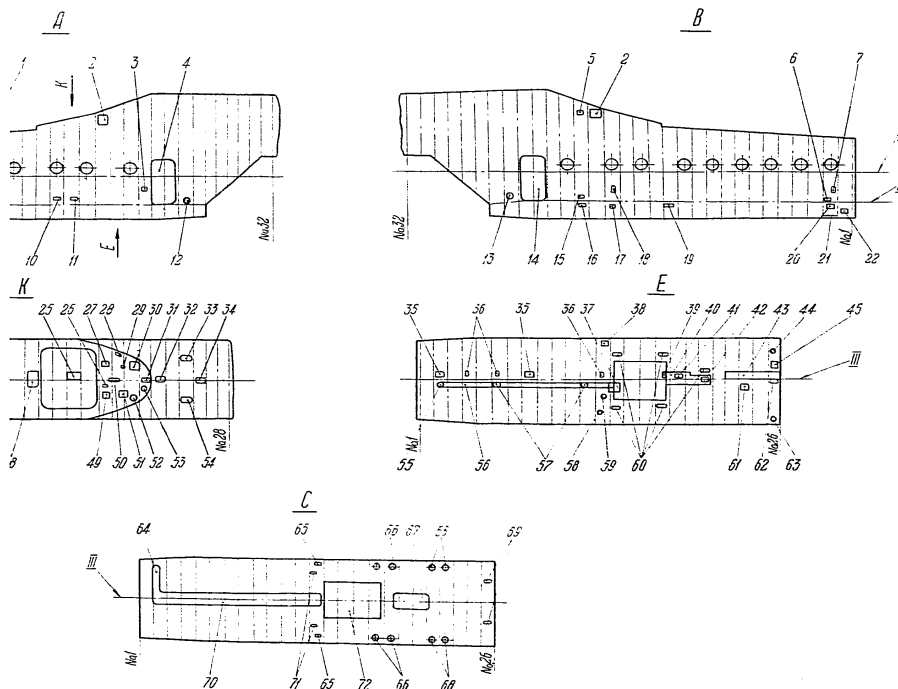


DIAGRAM SHOWING ARRANGEMENT OF HATCHES AND HOLES ON FUSELAGE CENTRAL PART
 A-view B-starboard view C-view of stress-carrying floor upper covering K-view along arrow K E-view
 I-helicopter reference line II-stress-carrying floor line III-helicopter axis of symmetry
 1-hatch for front doorway; 2-hole for wing centre-plane beam; 3-hatch for charging oxygen bottles; 4 and
 5-hatches for installation of fuel transfer pipe; 6-hatch for dispensing fuel to
 helicopter used as a flying tank; 7-fuel tank filler hatch; 8-hatch for ground electric power supply
 hatch for helicopter grounding bar; 10-hatch for pneumatic system ground supply panel; 11-hatch for
 ground supply panel; 12 and 13-hatches for airborne materiel exhaust gas outlet; 15-hatch giving access
 to fuel pipeline; 16 and 19-hatches for installation of fuel vent and inert gas supply pipelines; 17-hatch for passing
 fuel pipeline; 18-hatch for filler of fuel tanks Nos 7 and 8; 20-hatch for installation of fuel pipeline and
 fuel drain cock; 21-hatch giving access to inboard refuelling unit; 22-hatch for inboard refuelling unit;
 lifting pulley; 24 and 71-hatches giving access to cabin air heating lines; 25-slip ring assembly access
 holes for passing tail rotor control cables; 27 and 49-recesses for generators CFC-90/360; 28-hatch
 for fuel system pipelines; 29-hatchway for fuel pipes running from tank No.11; 30 and 52-hatches giving
 access to top plate of fuel tank No.11; 31, 32, and 34-tail shaft support inspection hatches;
 access to top plate of fuel tank No.10; 35 and 36-hatches giving access to fuel pipeline; 37 and
 access to fuel drain cocks with cargo compartment central hatch doors closed; 38-hatch giving access
 to city transmitter; 40, 43, 56, 64 and 70-detachable panels; 41, 55, and 57-hatches for access to fuel
 lines; 42-hatch providing access to fuel tank drain cock; 44-hydraulic system pipeline access hatch;
 access to loading ramp control microswitches; 46-hatch for engine thermocouples; 47-hatch for
 engine rear support fastening bolts; 48-gear box compartment inspection hatch; 50-hatchway for tail
 for installation of fuel pipeline; 54-hatch giving access to top plate of fuel tank No.9; 58-hatch
 joint of cabin heating line connections; 59-hatch for installation of fuel pump drain cock; 60-hatches
 of pneumatic system line; 61-hatch for installation of MP-11-500 receiver and inboard antenna; 62-hatch
 fuel pipeline connections; 63-hatch for connection of hydraulic system pipelines; 65, 66, and 68-pro-
 cesses; 69-hatches for loading ramp actuating cylinders; 72-central hatch in stress-carrying floor.

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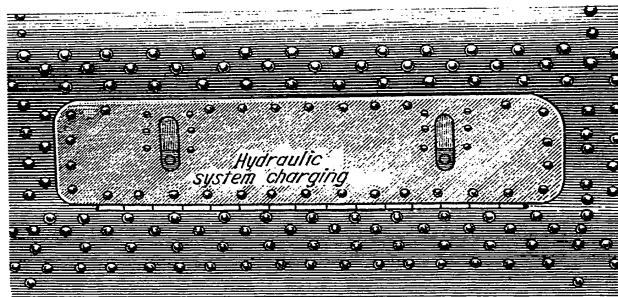


FIG. 47. HATCH ON FUSELAGE PORT SIDE GIVING ACCESS TO HYDRAULIC SYSTEM CHARGING UNIONS
(hatch door closed).

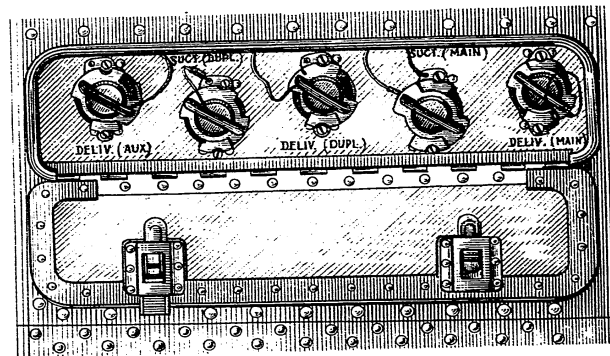


FIG. 48. HATCH GIVING ACCESS TO HYDRAULIC SYSTEM CHARGING UNIONS
(hatch door open).

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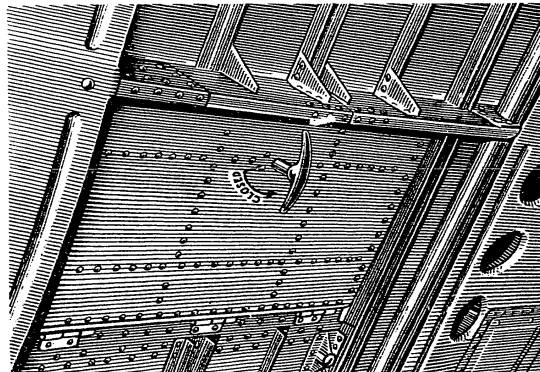


FIG. 49. HATCH IN CARGO COMPARTMENT CEILING FOR INSPECTION OF GEAR BOX COMPARTMENT
(hatch door closed).

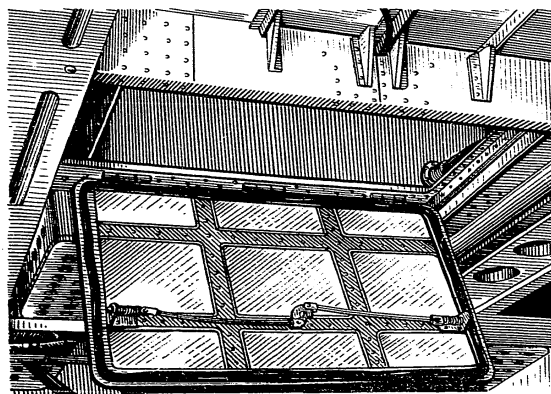


FIG. 50. HATCH FOR INSPECTION OF GEAR BOX COMPARTMENT
(hatch door open).

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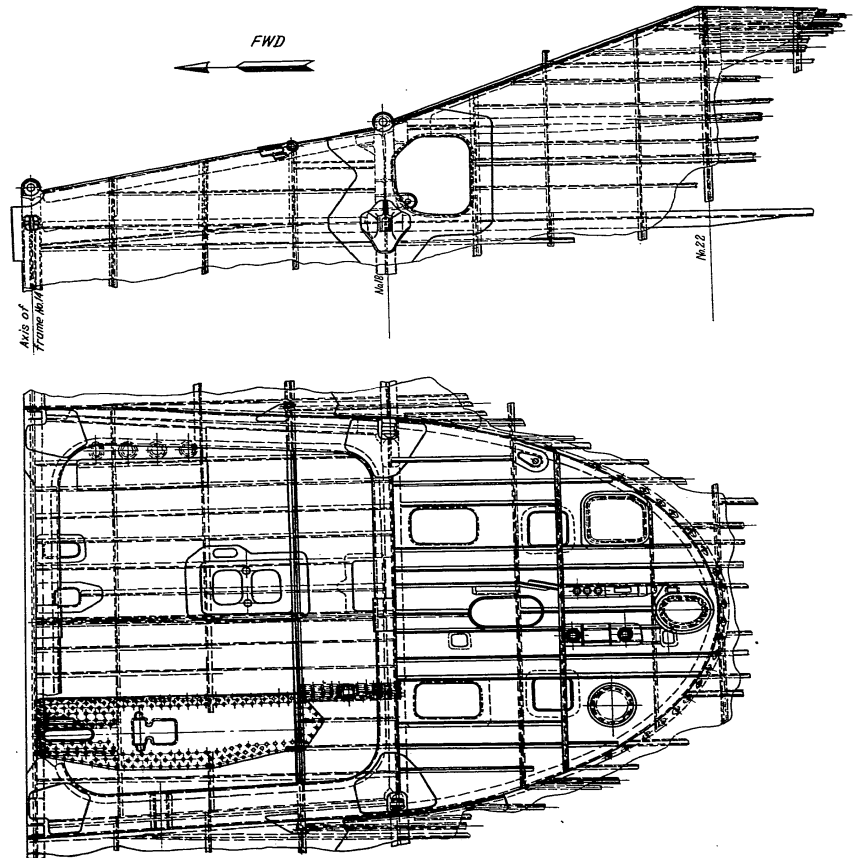


FIG. 51. GEAR BOX COMPARTMENT.

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On both sides of the fuselage, between frames Nos 18 and 19, holes are cut for the centre-plane beam of the wing (see Fig.51). These holes are edged with section bars that form frames to take loads transmitted from the tail boom along the side panels.

UPPER CONTAINERS

Located between frames Nos 19 and 26 above the cargo compartment (in the superstructure) are containers of the three bag fuel tanks (Fig.52).

The front container is arranged laterally between frames Nos 19 and 22, and the two rear containers, longitudinally between frames Nos 22 and 26. After installation of the fuel tanks, the containers are protected with stressed covers secured by screws with self-locking nuts.

The container upper portions are provided with cut-outs along whose contours the plates of the bag fuel tanks are secured. Riveted to the skin along the container upper rims are sleeves intended for receiving the pins of the fuel tanks.

On the stretch between frames Nos 19 and 26, the covering of the cargo compartment ceiling performs the function of the bottom of the containers. Made in the covering under each container are cut-outs along whose contours the plates of the pumps and fuel tank drain pipe connections are secured. The cut-outs are reinforced with edging strips.

Along the riveted seams, the internal surface of the containers is cemented with percale bands. Glued to the bases of the containers are plates of foamed plastics providing for the desired tilt of the tank bottom to ensure full consumption of the fuel.

Running above the ceiling of the containers are the tail shaft (resting on supports at frames Nos 22 and 26) and the tail rotor and stabilizer control cables.

TAIL COMPARTMENT

The tail compartment is located between frames Nos 26 and 42 behind the containers (see Fig.29). The last frame No.42 is jointed with the tail boom.

Running through the upper portion of the tail compartment is the tail shaft which is carried in supports mounted on frames Nos 31, 36, and 41. The tail rotor and stabilizer control cables run beside the shaft.

In the lower portion of the tail compartment, between frames Nos 33 and 35, there is a large hatchway leading from the cargo compartment into the tail boom (Fig.53).

A sheet duralumin panel 350 mm wide and serving as a catwalk towards the tail boom is run on the lower flanges of frames Nos 31 to 42 along the helicopter axis. Stiffness of the panel is increased by plates arranged in the fore-and-aft direction.

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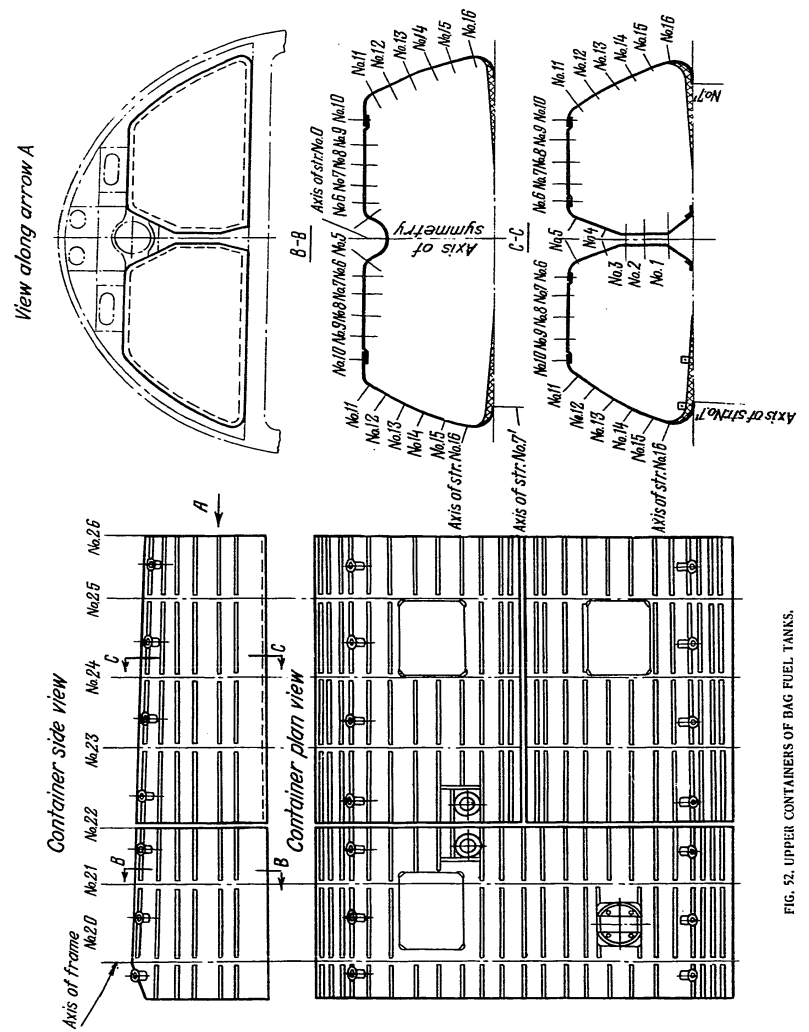


FIG. 52. UPPER CONTAINERS OF BAG FUEL TANKS.

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STANDARD GEAR BOX MOUNT AND LANDING GEAR
ATTACHMENT UNITS

The main gear box mount attachment units are installed on the superstructures of frames Nos 14 and 18 in the corners of the gear box compartment. Due to the fact that these attachment units carry substantial vibration loads, they are stamped of high-strength vibration-proof steel, grade 40XHMA.

The units on frame No.14 (Fig.54) are bolted to the stress-carrying extrusions of that frame; bolted, too, are attachment units on frame No.18 (Fig.34). The upper attachment units of the L.G. shock strut (see Fig.55) and the hinged supports for the wing spar are attached to the lower parts of the gear box mount attachment units with use made of bolts.

The upper attachment units of the L.G. shock struts on frame No.18 (Fig.55) are stamped of steel, grade 30XICA, and secured with bolts to the upper fittings of the side members of frame No.18, as well as to the angle fittings located under the cargo compartment ceiling. The fittings arranged under the base of the gear box mount units on frame No.18 have lugs (Fig.33) for attaching the external sling.

The lower attachment units of the L.G. nose shock strut are 30XICA steel stampings mounted along the axis of the first frame of the stress-carrying floor. These units are bolted to the upper and lower flanges of frame No.1 (in its lower portion).

The L.G. axle shaft attachment units (Fig.56) are mounted at the stress-carrying floor level on both sides of the helicopter (in the lower parts of the side members of frame No.18). These units are also stamped of steel, grade 30XICA, and bolted to the fittings installed inside the fuselage.

The L.G. brace strut attachment units (Fig.57) are arranged at the floor level on both sides of the fuselage (in the lower parts of the side members of frame No.22). The lower parts of the attachment units have spherical recesses for the ball-type supports of the hydraulic jacks.

The other constructional features and the mode of fastening are similar to those of the L.G. units mounted in the lower parts of side members of frame No.18.

In addition to the above mentioned attachment units arranged on frame No.22, there are two more welded cromansil units with cups for ball-type supports of the jacks. These units are riveted into the framing of the stress-carrying floor near frame No.1 and are made use of when installing the fuselage on the hydraulic jacks.

STRESS-CARRYING FLOOR

The stress-carrying floor is 11,725 mm long and has a maximum width of 2520 mm (as measured at frame No.26).

The stress-carrying framework of the floor (Fig.58) is made up of the longitudinal and lateral framings. Used for the lateral framing of the floor are the lower portions of frames Nos 1 to 26 inclusive.

The longitudinal framing includes two stressed beams, arranged in symmetry with the longitudinal axis of the helicopter at a distance of 1436 mm from each other, and Z-shaped B95 duralumin extrusions with a web 90 mm high that are attach-

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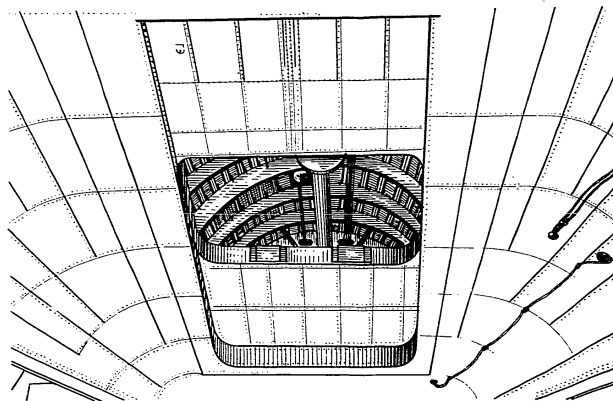


FIG. 53. HATCHWAY LEADING INTO TAIL BOOM.

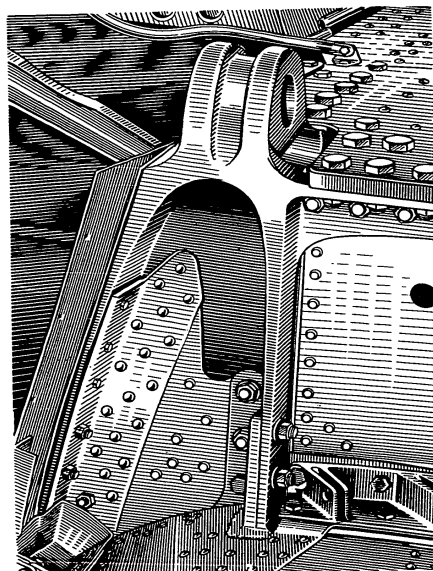


FIG. 54. GEAR BOX MOUNT ATTACHMENT UNIT ON FRAME NO.14.

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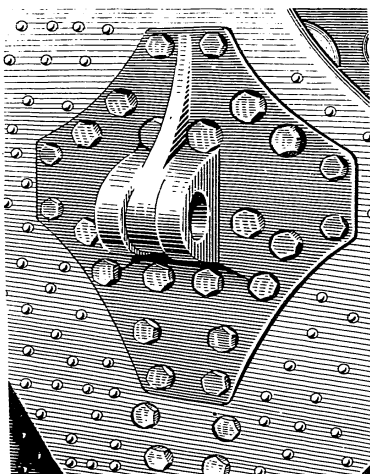


FIG. 55. L.G. TWO-CHAMBER SHOCK STRUT ATTACHMENT UNIT ON FRAME NO.18.

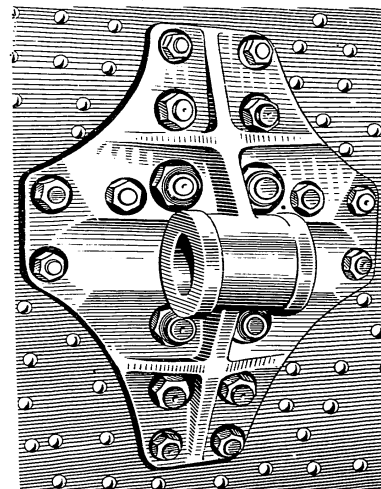


FIG. 56. L.G. AXLE SHAFT ATTACHMENT UNIT ON FRAME NO.18.

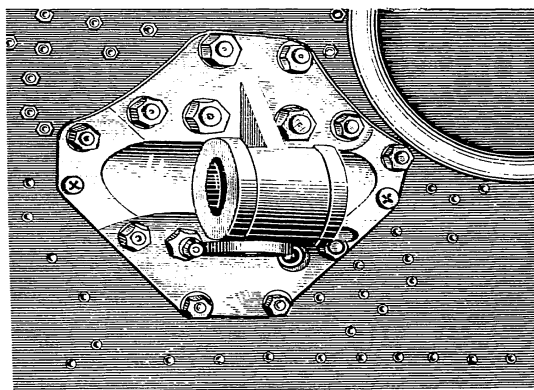


FIG. 57. L.G. BRACE STRUT ATTACHMENT UNIT ON FRAME NO.22.

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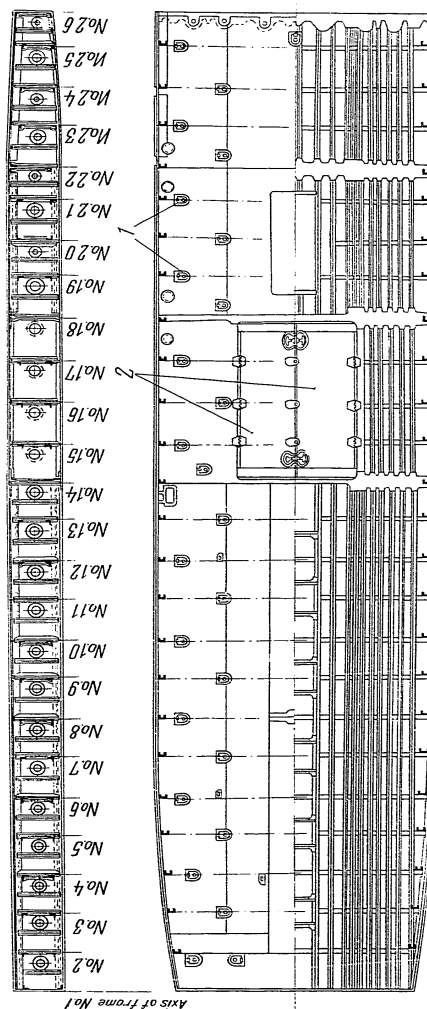


FIG. 58. STRESS-CARRYING FLOOR FRAMEWORK
1—cargo tie-down units; 2—central hatch doors.

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ed to the upper transverse flanges of the lower portions of the frames. These extrusions are 115 mm apart from each other, being arranged in sevens to either side of the helicopter axis of symmetry and jointed on frames Nos 14, 18, and 22 with use made of fittings.

Strong transverse flanges of the lower portions of frames Nos 18 and 22 run from the port side to the starboard, being secured in the stressed L.G. attachment units, and the transverse flange of frame No.14, in the framing of the side member base.

The lower portion of frame No.14 serves as a bulkhead whose wall between the longitudinal beam axes is manufactured of sheet duralumin AI6A-T H0.8. The portions of the bulkhead to the right and left of the beams are made of sheet duralumin AI6A-T H1.0 and reinforced with cover plates of the same material.

The bulkhead component walls are edged with AI6-T HK-4 duralumin sections. Besides, rigidity of the walls is increased due to the vertically mounted angle section bars. A similar design have the lower portions of frames Nos 18 and 22, too.

Eight containers for bag fuel tanks are arranged between the lower portions of frames Nos 2 to 4, 4 to 6, 6 to 8, 8 to 10, 10 to 12, 12 to 14, 18 to 20, and 20 to 22. Construction of the lower portion of the standard frame thrust against the container end face is shown in Fig.59.

Unlike the above frames, the lower portions of frames Nos 23, 24, 25, and 26 have a single web reinforced only with angle bars mounted between the longitudinal beams.

To provide for accommodation of the containers and the stress-carrying floor central hatch panel, middle lower portions between the longitudinal beams have been dispensed with in intermediate frames Nos 3, 5, 7, 9, 11, 13, 15, 17, 19, and 21. One of such frames is illustrated in Fig.60.

The containers arranged in the stress-carrying floor have smooth walls, due to which the middle portions of the frames separating the containers from one another are provided with double webs riveted between which are vertical II-shaped extrusions. The base and ceiling of a container are formed by panels supplied with double plating. Longitudinal ribs are riveted in between the plating sheets to stiffen the container which receives an excessive pressure of fuel in the bag tanks of up to 0.2 kg/sq.cm.

For installation of the bag fuel tanks, every container is provided with a detachable transverse panel mounting the fuel tank plate. Riveted along the side rims of the containers are sleeves receiving the fuel tank pins during installation.

To ensure proper mounting of the fuel pipelines, there are three detachable corrugated panels in the floor above the containers, with two Z-shaped section bars riveted to these panels along the longitudinal axis. The panels are held to the floor with screws and self-locking nuts arranged along their contour.

To make the airborne materiel fast on the stress-carrying floor, steel cargo tie-down units with rings are installed on it in chess-board order to either side from the fore-and-aft axis (Fig.61). These units are made in the form of welded steel brackets riveted into the floor just where Z-shaped section bars are jointed to the frames. These brackets have rings engaged by the hooks of the cargo tie-down ropes.

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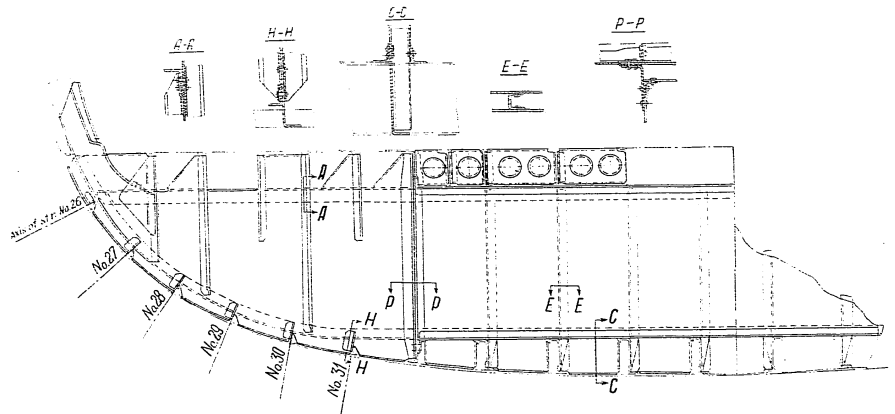


FIG. 59. STRESS-CARRYING FLOOR STANDARD FRAME FOR SEPARATION OF FUEL TANK CONTAINER.

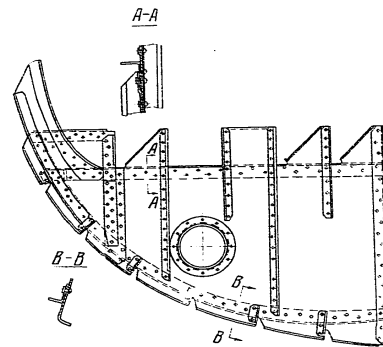


FIG. 60. STRESS-CARRYING FLOOR STANDARD FRAME.

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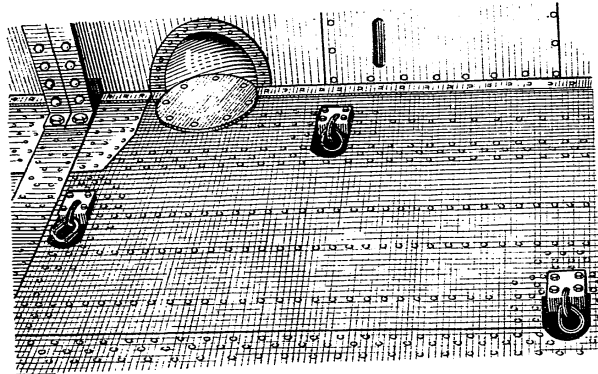


FIG. 61. TIE-DOWN UNITS ON STRESS-CARRYING FLOOR FOR MAKING FAST AIRBORNE MATERIEL AND CARGO.

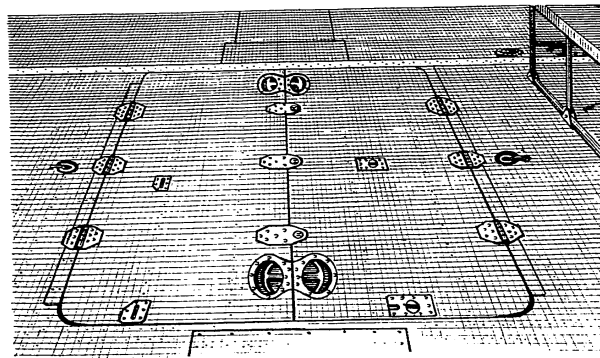


FIG. 62. STRESS-CARRYING FLOOR CENTRAL HATCH WITH DOORS CLOSED.

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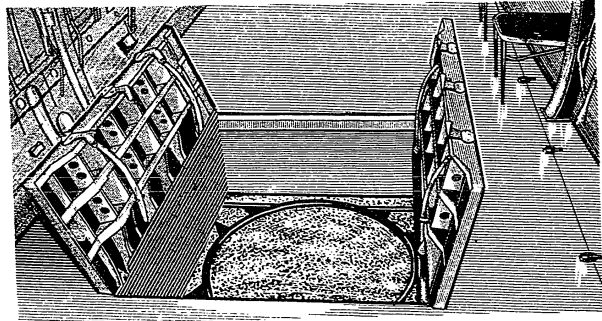


FIG. 63. STRESS-CARRYING FLOOR WITH OPEN CENTRAL HATCH DOGGS AND GUARD RING VINYLE.

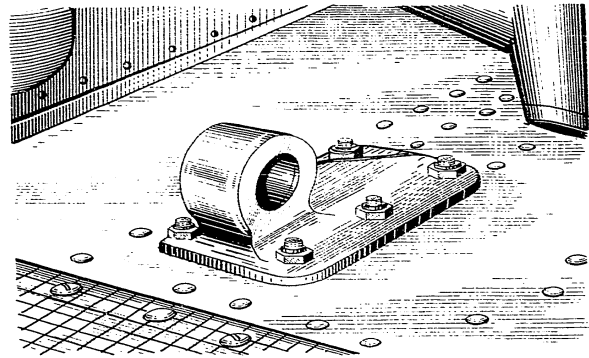


FIG. 64. PULLEY BLOCK BRACKET INSTALLED ON CARGO COMPARTMENT FLOOR BETWEEN FRAMES NOS 1 AND 2.

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The upper portions of the brackets and the rings can be stowed into bowl-shaped recesses to become flush with the floor. The bowl stampings are riveted along their contour to the floor corrugated covering.

To add to rigidity of the floor, steel strips are riveted on top of it to the flanges of frames Nos 18 and 26.

Located in the stress-carrying floor between frames Nos 14 and 18 is the central hatch of a rectangular shape (as viewed from above) and measuring 1620 mm in length and 1250 mm, in width. To form a strong frame for the hatch cut-out in the stress-carrying floor, the longitudinal beams and frames are reinforced with additional webs and extrusions fastened in the corners with special fittings.

A spring damper of the main L.G. shock strut hydraulic interconnection system is mounted on brackets between frame No.14 and the additional web further to the front (in the flight direction).

The central hatch doors (Figs 62 and 63) are made up of two upper and two lower leaves kinematically linked in pairs.

An upper leaf is a riveted structure composed of the longitudinal and lateral framings. These include Z-shaped section bars 90 mm high and interconnected with angle plates and knees.

The leaves are hung on hinges, their front and rear edges resting upon the flanges of frames Nos 14 and 18. When in the closed position, the leaves are retained with special locks thus forming a platform which takes the weight of the airborne cargo and materiel.

The lower leaves of the hatch doors are made of the MAS JI.2 sheet elektron stampings with the MAS JI elektron plating riveted to them. The lower leaves are also hinged and are kinematically linked with the upper ones by means of two control rods adjustable in length. With the hatch doors closed, these rods prevent the lower leaves from getting open. When in the open position, the leaves are fixed with a lock.

The floor surface is cut to provide for production hatches whose doors are secured along the contour with screws and self-locking nuts.

Installed between frames Nos 1 and 2 along the fore-and-aft axis of the helicopter are reinforced sections and fittings for attachment of the plate carrying the JMT-3 hoist.

The plate is stamped of alloy AK6 and fastened to the floor with bolts 8 mm in diameter and with self-locking nuts riveted to the floor covering from the bottom. The bolts are locked with wire passing through the holes in their heads.

The JMT-3 hoist is installed on the plate and secured with four bolts 14 mm in diameter. The hoist is protected on top with a panel which forms the threshold of the crew's cabin entrance door.

At its left the hoist is provided with a bracket to secure the pulley block (Fig.64).

CARGO COMPARTMENT DOOR PANELS AND LOADING RAMPS

The cargo compartment door panels protect the main doorway in the helicopter cargo compartment through which cargo and materiel are loaded and unloaded.

The panels are framed leaves which, when closed, form the rear streamlined contour of the fuselage. They are arranged between frames Nos 26 and 40 (see

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Figs 30 and 65), being hung on hinges mounted on slant frame No.43 at its joints with frames Nos 26 and 31.

The cargo compartment door panels are operated by means of the hydraulic mechanism installed in the upper part of the fuselage between the bases of frames Nos 37 and 38. When in the closed position, the door panels are additionally fixed with a hydraulic lock located on the panels near the cut-out for the main loading ramps.

Each door panel consists of a framework and a skin. The panel lateral framing includes fifteen frames (Figs 65 and 66) one of which is reinforced and installed at a certain angle. The longitudinal framing is made up of stringers fabricated from the BMG5-I Hp100-3 elektron section bars.

To add to rigidity of the panel, use is made of the upper horizontal and lower horizontal and vertical beams edging the loading ramp cut-out and the panel joint.

The panels are faced with the MAB JI.O elektron sheets held to the framework by lentil-head rivets.

The hinge attachment areas of the panels are reinforced by adding partitions and knees. Arranged in the top rear corner of each door panel are attachment fittings of the hydraulic control mechanism rod that are cast of magnesium alloy M15; the fittings are riveted to the framework.

On the right-hand door panel, between frames Nos 7 and 8, there are ten exhaust ventilation louvres (Fig.67). From inside the cargo compartment, the louvres are blanked off with a shutter sliding in guides.

The loading ramps (Figs 66 and 68) consist of two main and two end ramps as well as of eight separate panels.

The ramps are extended and retracted by the hydraulic mechanism in a certain succession. The main loading ramps are lowered after the door panels have been opened and are raised before the panels have been closed. The end ramps are set to the working position before the main ramps have been lowered and are retracted before the latter ones have been raised.

The hydraulic actuating cylinders intended for extension and retraction of the main loading ramps are mounted on special brackets under the floor of the cargo compartment, between frames Nos 25 and 26. The brackets are secured to the web of frame No.25 with bolts.

Provided in the floor covering for installation and inspection of the hydraulic cylinders are production holes protected with covers. The hydraulic cylinders actuating the end ramps are installed in the rear of the main loading ramps.

The main loading ramps are hinged to the lower rim of frame No.26 on the attachment fittings stamped of steel, grade SOXICA. Each ramp is hung on two fittings whose axes are inclined relative to the helicopter longitudinal axis, slightly rising towards the fuselage sides. Owing to such an arrangement of the fittings, the main loading ramps go apart when extended thus increasing the width of the track along which the materiel is rolled inside the cargo compartment.

When in the lowered position, the ramp inclination angle is 17 to 20°.

The main loading ramp is a strong box comprising five longitudinal beams and lateral partitions. The upper skin of the ramp is made of a corrugated duralumin sheet. To increase the ramp stiffness and the friction during the movement of materiel along the ramps, sixteen transverse strips stamped of alloy AK6 are riveted to the ramp skin at an interval of 100 mm from one another.

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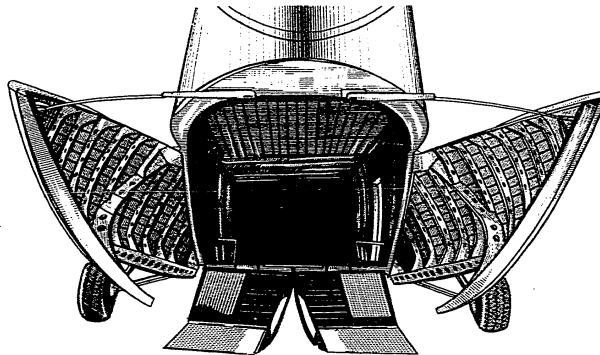


FIG. 65. CARGO COMPARTMENT DOOR PANELS AND RAMPS IN OPEN POSITION.

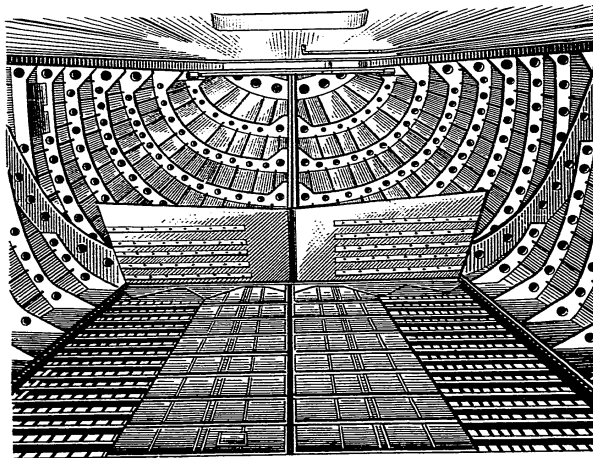


FIG. 66. CARGO COMPARTMENT DOOR PANELS AND RAMPS IN CLOSED POSITION
(interior view of door panel framework).

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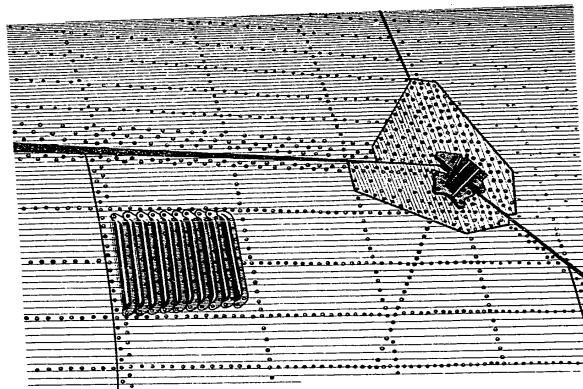


FIG. 67. EXHAUST VENTILATION LOUVRES ON CARGO COMPARTMENT STARBOARD DOOR PANEL.

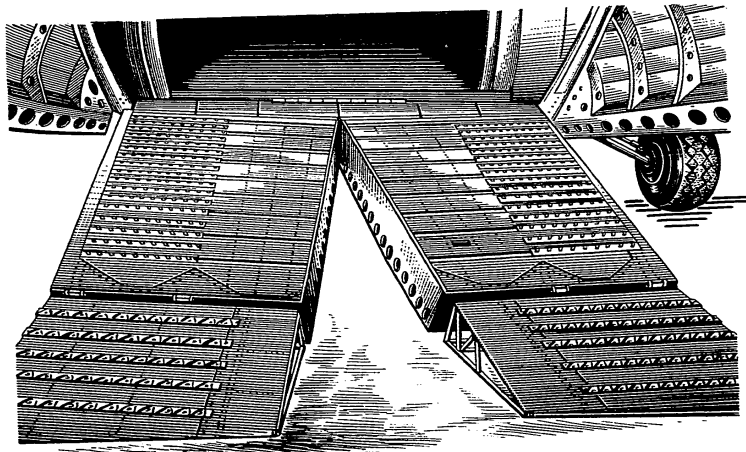


FIG. 68. LOADING RAMPS IN EXTENDED POSITION.

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The bottom sides of the loading ramps are covered with sheet duralumin Δ I6-T Δ I.0.

Hinged to the main loading ramps are end loading ramps (see Fig.68) made in the form of a hinged frame welded of 30XICA steel tubes. Riveted on top of the frame are duralumin corrugated sheets to which, just as in the case of the main ramps, transverse strips stamped of alloy AK6 are fixed.

When in the lowered position, the bottom surface of the end ramps rests directly on the ground.

The slot between the upper rims of frame No.26 and the main loading ramps is closed with six guard strips hinged on steel brackets that are bolted to the steel binding of the frame. The strips are made of magnesium alloy Δ M5. The two middle strips mount rollers preventing the winch wire rope from getting frayed when cargo is being pulled into the cargo compartment.

The space between the two main and two end loading ramps (formed when the loading ramps go apart) is covered with detachable middle ramps (the upper and the lower ones).

The upper middle ramp is held to the right main ramps, with two pins. Its left-hand edge is free, being able to slide on the surface of the left main ramp. The ramp is made of a corrugated sheet of duralumin Δ I6A-T Δ I.2 with a 3-mm plywood sheet riveted to it from the bottom. The plywood is reinforced from both sides with duralumin Δ I6A-T Δ O.6.

Along its contour, the ramp is edged with moulded Δ I6A-T Δ I.2 duralumin sections.

Just like the upper middle ramp, the lower middle ramp is manufactured of a corrugated duralumin sheet (Δ I6A-T Δ I.2), to whose bottom a sheet of duralumin-reinforced plywood is riveted. Along its contour the ramp is edged with moulded sections.

The lower middle ramp is secured to the right end loading ramp with two pins.

GEAR BOX MOUNT

The gear box mount (Fig.69) is designed for attachment of the P-7 main gear box on the helicopter. It receives the static and variable dynamic loads acting on the helicopter while in flight.

The gear box mount consists of four main brace struts (Ref.Nos 1 and 3) and four detachable brace struts (Ref. Nos 2 and 4) connected in twos with bolts 10 to form V-shaped brace struts (units B and C). The fastening bolts of detachable brace struts measure 32 mm in diameter and are manufactured of steel, grade 30XICA, and heat-treated up to $\sigma_B = 110 \pm 10$ kg/sq.mm.

The lower attachment units of front main brace struts 1 are secured to the respective units installed on frame No.14 of the fuselage central part, and rear main brace struts 3, to the units on frame No.18. To do so, use is made of bolts 9, 45 mm in diameter, which are made of steel, grade 40XHMA, and heat-treated to $R_c = 35 - 41$.

Mounted on the brace strut upper attachment units with spherical bearings 7 press-fitted into them is the gear box carrying on its walls eight mating units with lugs. The brace strut units are connected to the gear box unit lugs with bolts 8, 45 mm in diameter, manufactured of steel, grade 40XHMA, and heat-treated up to $R_c = 35 - 41$.

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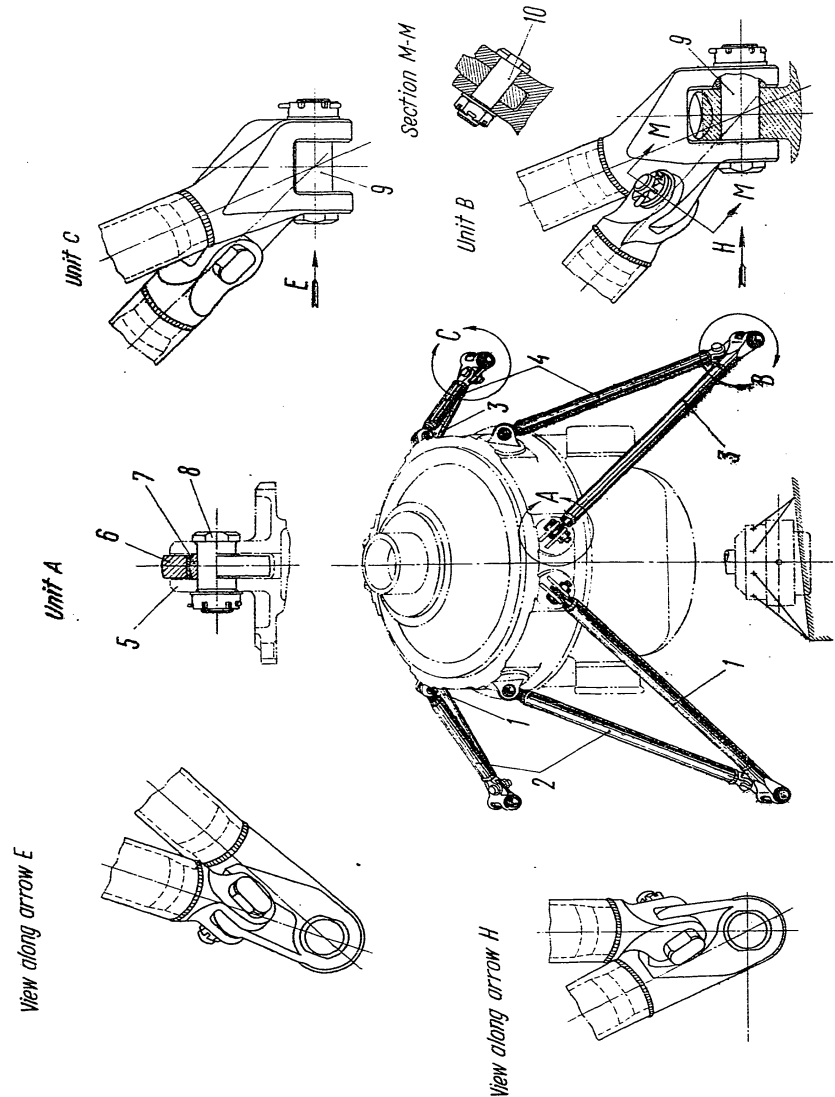


FIG. 69. GEAR BOX MOUNT
 1,3—main brace struts; 2,4—detachable brace struts; 5—gear box wall unit for attaching gear box mount; 6—gear box wall unit for attaching gear box mount; 7—spherical bearing; 8,9—gear box mount fastening bolts; 10—detachable brace strut fastening bolt.

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Each brace strut is thick-walled cromansil tube 89 x 79 mm in diameter whose ends have been upset to a still greater thickness with a view to increasing the welding area.

All the attachment units are cromansil stampings butt-welded to the main and detachable brace strut tubes. After the attachment units have been welded up, the brace struts are heat-treated to $\sigma_B = 115 \pm 15$ kg/sq.mm.

To obviate corrosion, the gear box mount is cadmium-plated.

3. TAIL BOOM

The tail boom is 6290 mm long and shaped as a truncated cone, the diameters of its circumferential faces being 1760 and 1200 mm.

The boom is designed as a monocoque with a smooth stress-carrying skin (Figs 70 and 76). The tail boom framework is assembled of frames and stringers.

The tail boom has a longitudinal production joint to ensure convenience in its manufacture; this permits each boom half to be assembled separately.

The boom lateral framing comprises eighteen frames spaced all over the boom length at intervals of 370 and 375 mm from one another. The face (front and rear) frames are manufactured from extruded angles: frame No.1 is made from $\Delta 16-T$ $\Pi p100-I3$ section bar, and frame No.18, from $\Delta 16-T$ $\Pi p100-I2$ section bar.

The top portions of frames Nos 5, 10, and 15 (Figs 72 and 73) are reinforced by stiffeners 6 (Fig.70) which serve for securing the tail shaft supports and are similar in design with those arranged on the frames of the fuselage tail part. The stiffeners are also stamped of aluminum alloy AK6 and are provided with longitudinal partitions which increase the rigidity of the supports in the longitudinal direction. Secured to the top reinforced portion of the frame by four bolts is the support with the bearing for the tail shaft (see Fig.71).

All the conventional-type (non-reinforced) frames of the tail boom are made from sheet duralumin. They comprise two Z-shaped half-rings (Fig.74) interconnected with the aid of riveted cover plates.

The tail boom longitudinal stringer set is secured to the outer flanges of the frame rings. It includes twenty-eight Π -shaped extruded bulb sections and nineteen bulb angle extrusions unequally spaced along the circumference. The bottom stringers, as well as the stringers located on the port side of the boom in the zone of compression, are spaced closer to one another and have a larger area of lateral section.

The stringers are secured to the frames with the aid of corner plates held with two rivets to the stringer and with two rivets to the frame. At the points of transition of the tail boom to the narrower portion of the cone, the Π -shaped stringer sections have cuts on one side.

Fixed to the tail boom framework with lentil-head rivets is the skin made from sheet duralumin $\Delta 16A-T$ 1.2 and 1.5 mm thick (see Fig.75). A thicker skin is riveted to the framework in the zone of compression; the skin sheets are overlapped. The longitudinal joints of the skin are located on the stringers, the skin sheets being interconnected with a two-row rivet seam, whereas the skin transverse joints are arranged on the frames and are done with two-row or three-row rivet seams.

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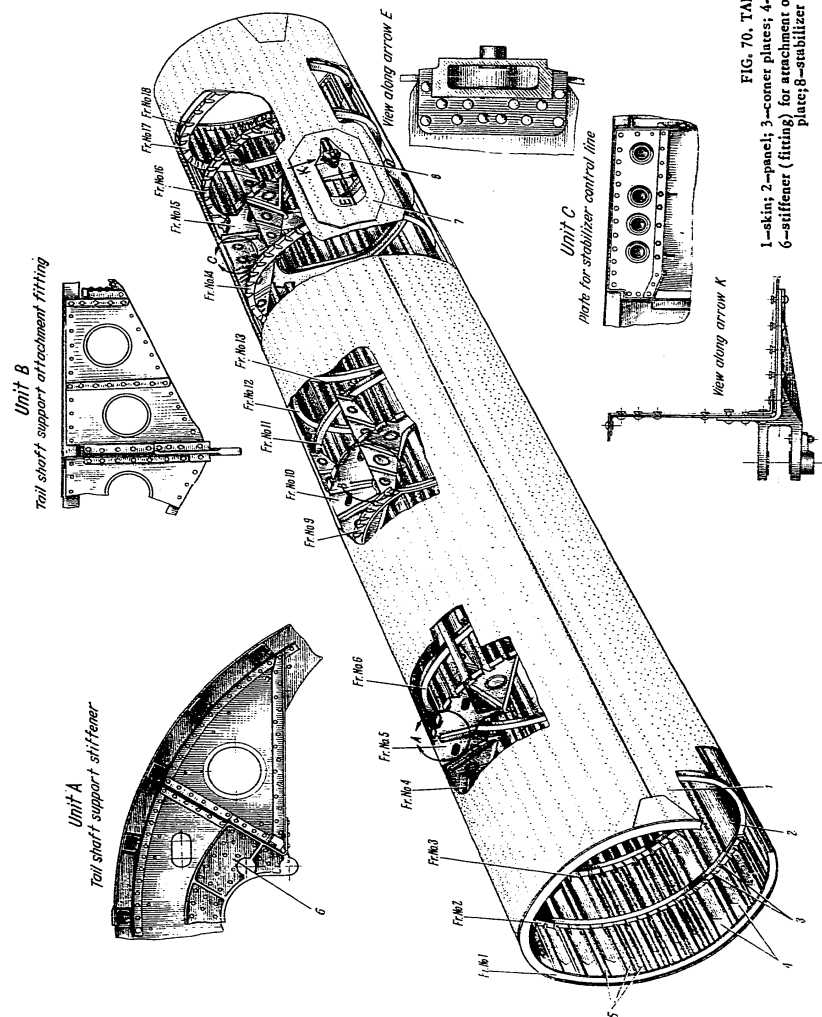


FIG. 70. TAIL BOOM
 1-skin; 2-panel; 3-corner plates; 4-scalloped band; 5-sunglers;
 6-stiffener (fitting) for attachment of tail shaft support; 7-cover
 plate; 8-stabilizer attachment fitting.

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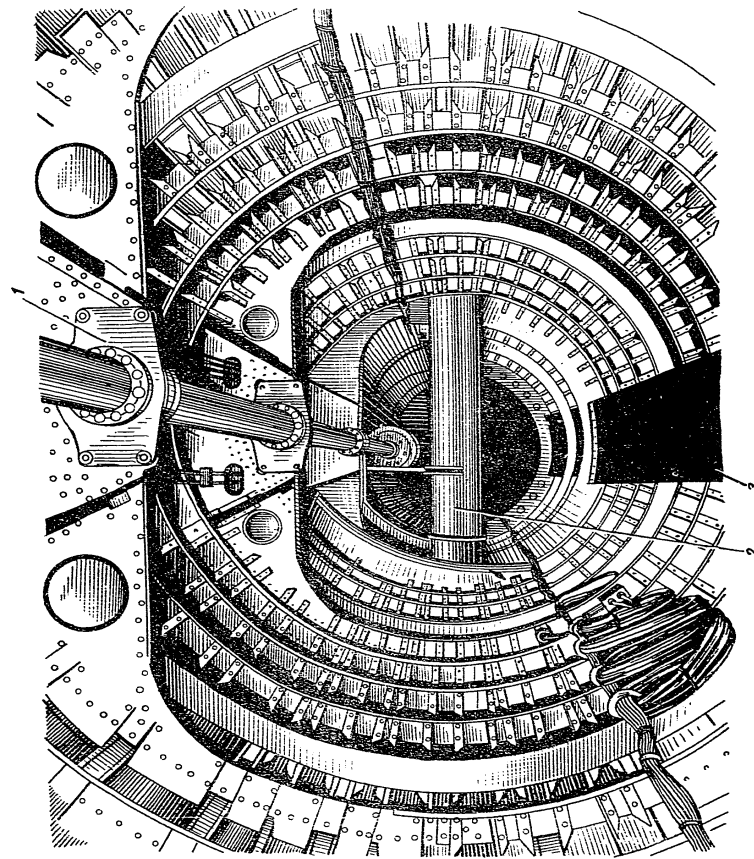


FIG. 71. TAIL BOOM STRESS-CARRYING FRAMEWORK (INSIDE VIEW)
1—tail shaft support; 2—stabilizer spar; 3—panel walk.

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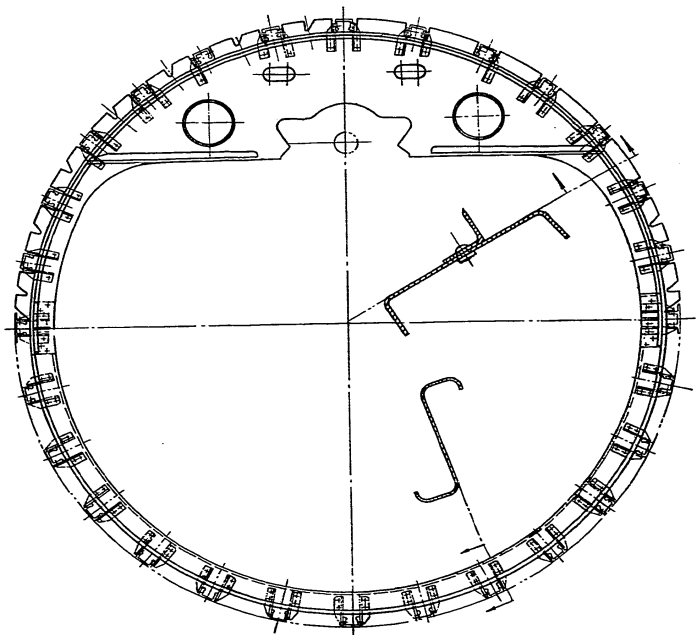


FIG. 72. STRESSED FRAME NO.5 OF TAIL BOOM.

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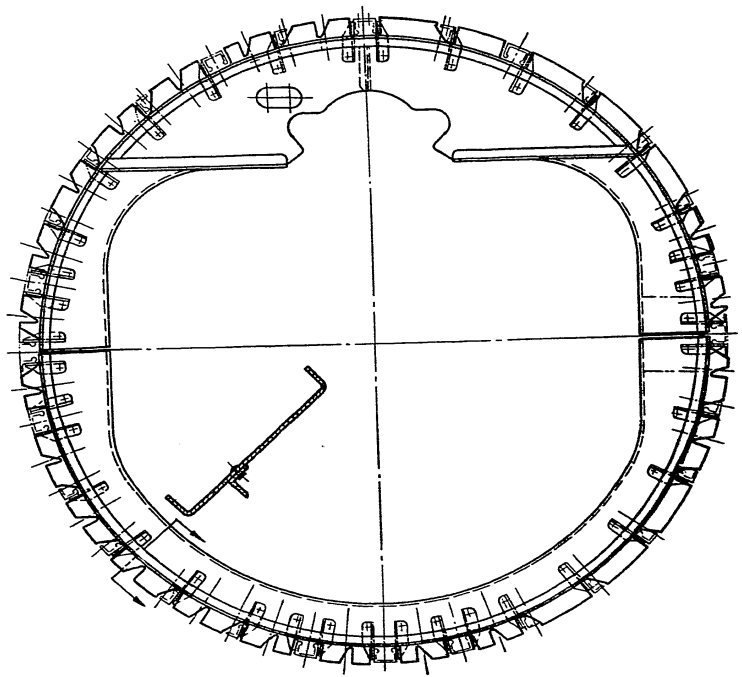


FIG. 73. STRESSED FRAME NO.15 OF TAIL BOOM.

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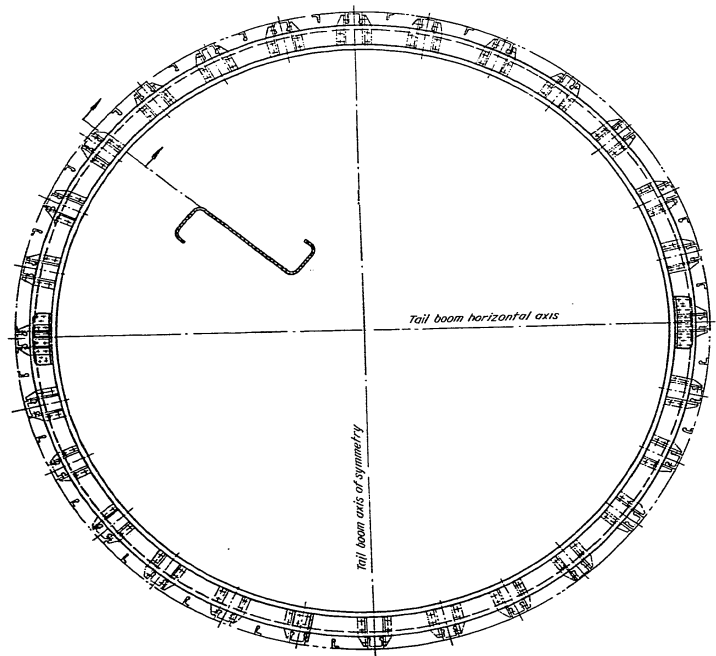


FIG. 74. STANDARD CONVENTIONAL-TYPE FRAME OF TAIL BOOM.

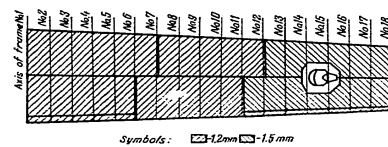


FIG. 75. DIAGRAM OF TAIL BOOM SKIN.

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The stabilizer attachment fittings are mounted on frame No.15 of the tail boom (see Fig.70).

The cuts in the boom between frames Nos 14 and 15 for the stabilizer spar are reinforced with riveted cover plates and sealed with canvas boots. The stabilizer spar attachment fitting is fabricated from an AK6 duralumin stamping.

To ensure convenient access through the inside of the tail boom to the tail shaft supports, the attachment fittings on the stabilizer spar, the intermediate gear box, and the control units, a sheet duralumin panel 350 mm wide is placed on the lower portions of the frames (see Fig.71). The panel is reinforced with longitudinal partitions.

The tail boom is jointed to the central part of the fuselage by twenty-eight bolts 12 mm in diameter and thirty-four 10-mm diameter bolts which interconnect the face frames (bulkheads), being slipped through fittings arranged on the ends of the stringers (Fig.76). The bolts are made from steel 18XHBA and are subjected to heat treatment. The fittings are manufactured from extruded sections, their walls being riveted to the vertical ridges of the stringers.

To reduce stress concentration in the skin, a scalloped band of sheet duralumin AI6A-T II.2 is placed under the fittings in the vicinity of the joint all over the contour of frames Nos 1 and 18.

The tail boom is secured to the pylon with the aid of forty-four 10-mm diameter bolts, made from steel 18XHBA, in the same way as it is fixed to the fuselage central part.

4. PYLON

The pylon comprises three parts: fin beam, fixed rudder, and detachable fairing.

The fin beam (Fig.77) is the continuation of the tail boom and is designed as a monocoque with a stress-carrying skin, too. The centre line of the beam deflects upward with respect to that of the tail boom in the vicinity of frame No.7.

The transverse framing of the fin beam consists of seven duralumin frames, thirteen ribs, and one end rib (Fig.78), whereas the longitudinal framing is made up of duralumin extrusions and sheet duralumin partitions. At the points of the fin beam deflection, the stringers are jointed to one another with the help of steel angle stiffeners. On the stretch from the face frame to the point of the fin beam deflection the longitudinal framing is similar to that terminating on the face frame of the tail boom. The fin beam face frame and the fittings secured to the stringers are identical with those of the tail boom.

To reduce stress concentration in the joint area, a scalloped duralumin band is placed under the fittings all along the contour of the face frame.

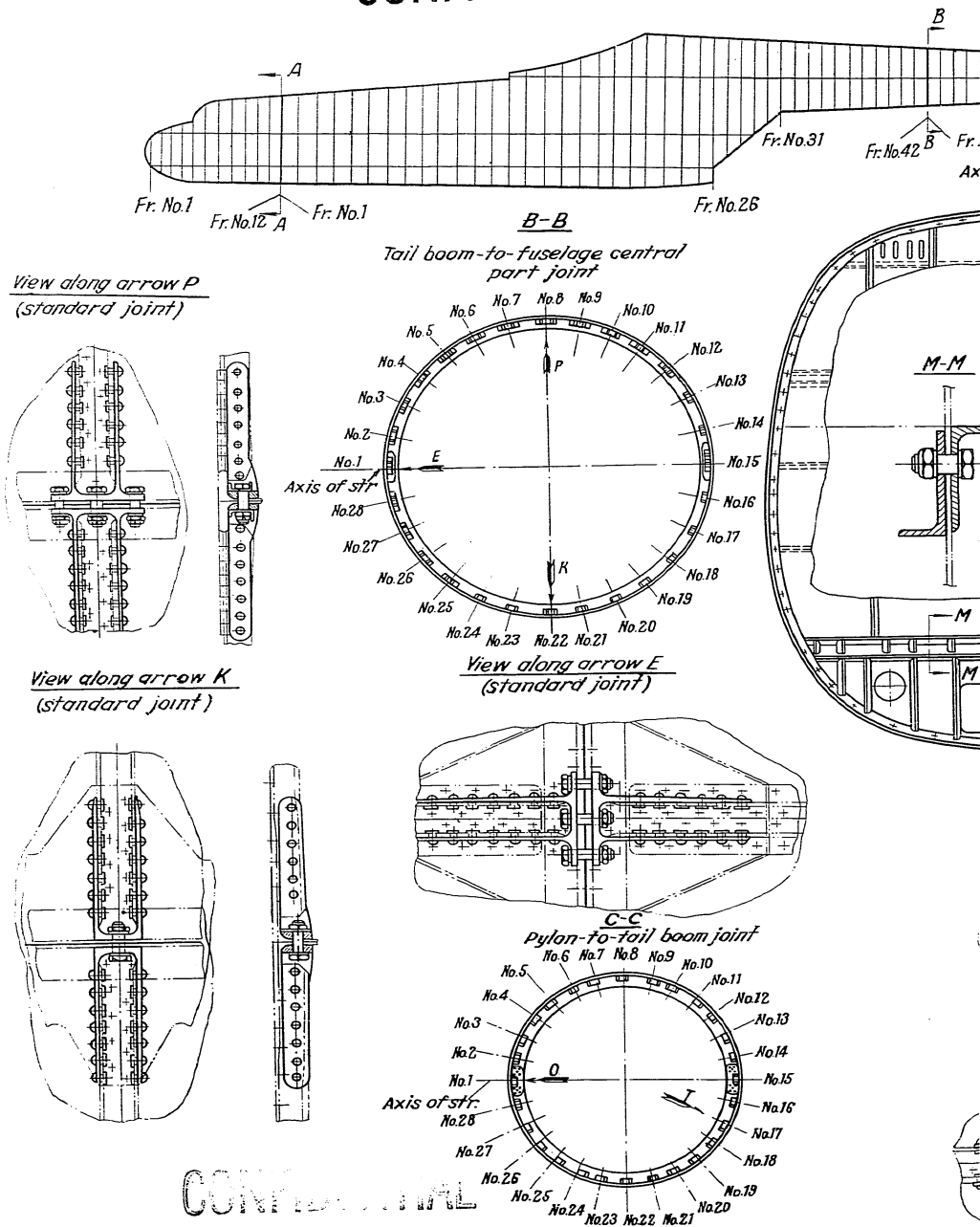
All the ribs are riveted to the slant spar of the fin beam and to the longitudinal framing which is assembled of extruded duralumin angles. Secured to the end rib, that is manufactured from a MM5 magnesium casting in the form of a flange, is the tail gear box.

The fin beam framework is covered with sheet duralumin AI6A-T. The thickness of the skin sheets is 1.0 to 1.8 mm on the starboard, and 1.2 to 1.8 mm on the port side. The skin transverse joints are done with two-row rivet seams. Secured to

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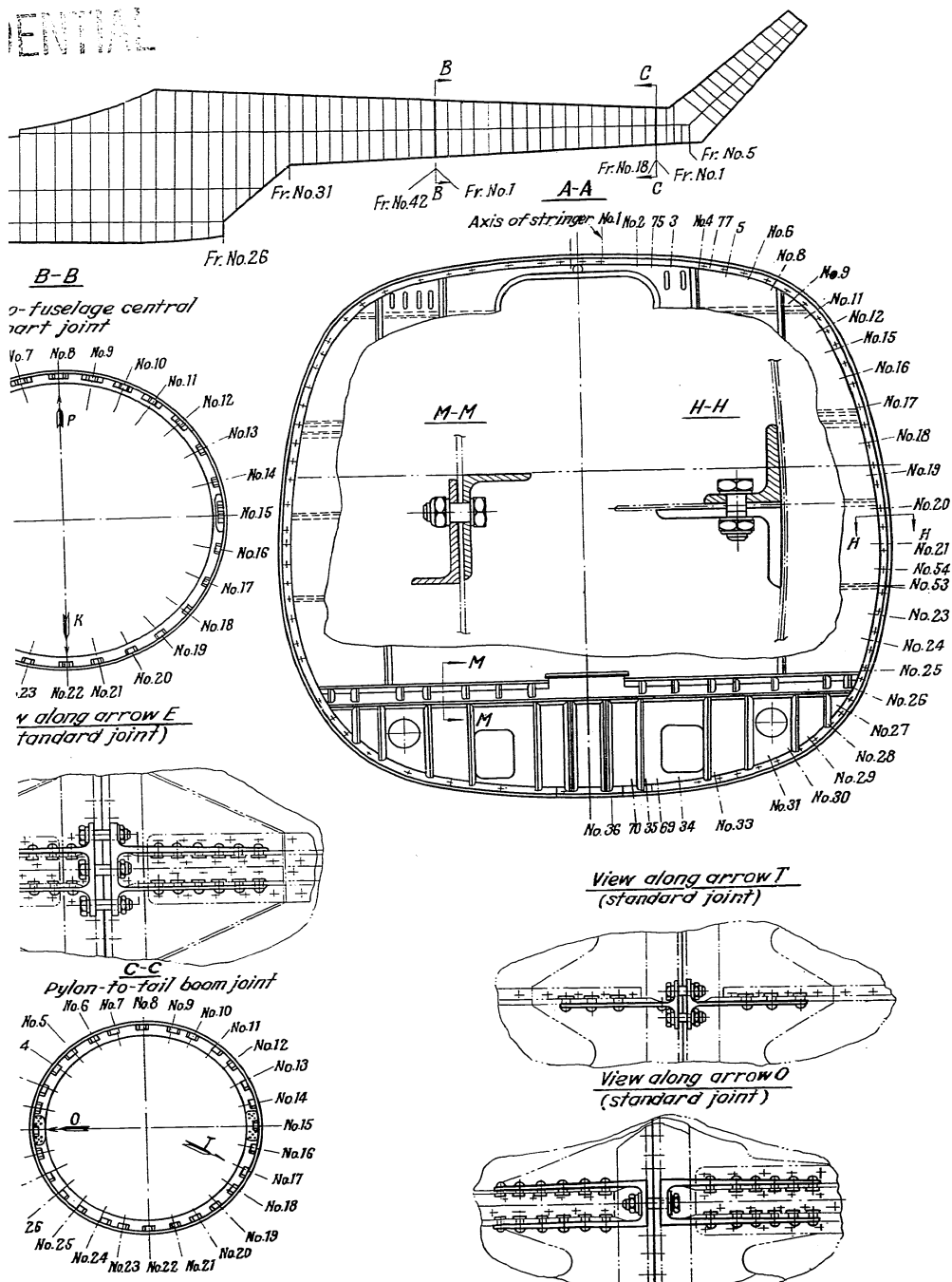
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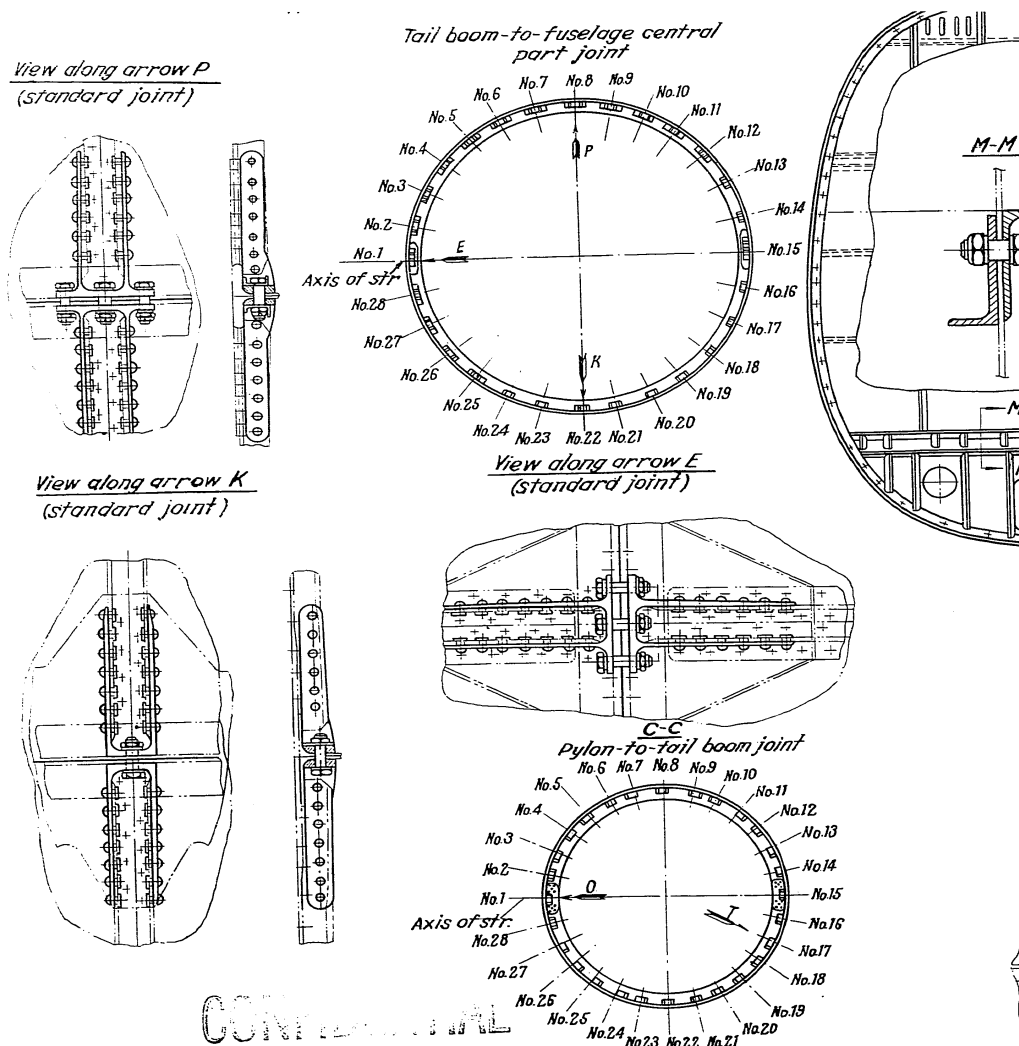
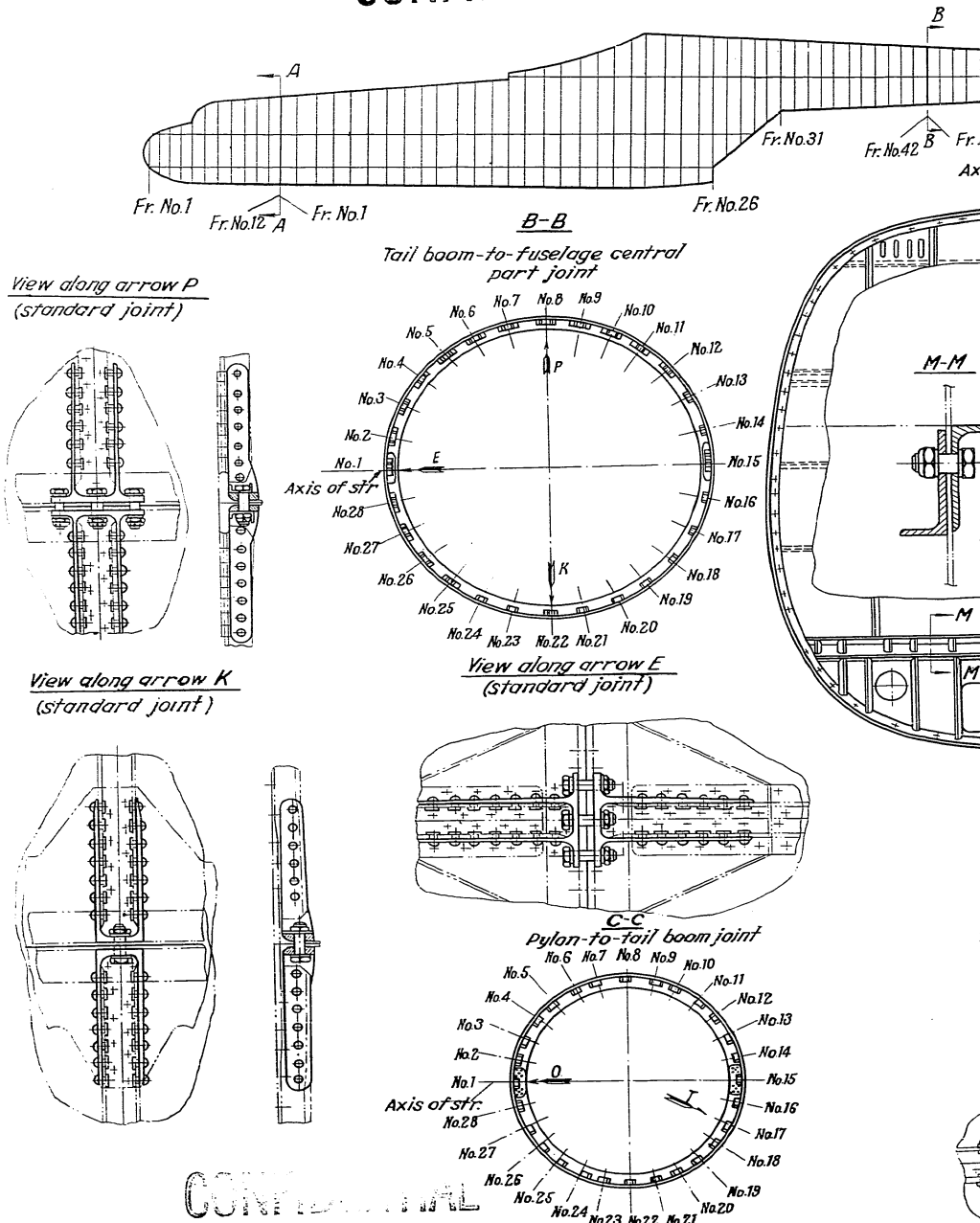


FIG. 76. DIAGRAM OF FUSELAGE JOINTS.

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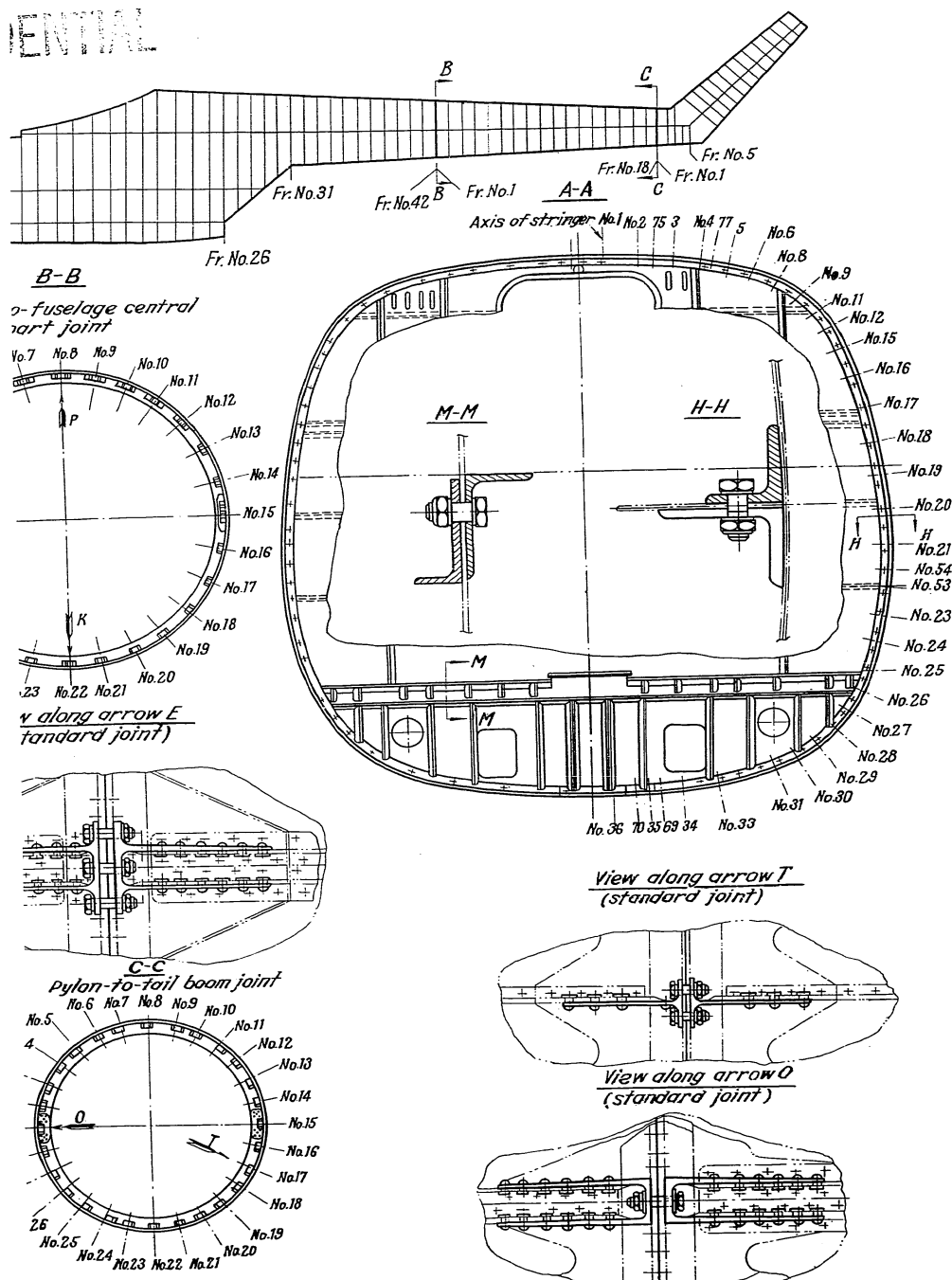
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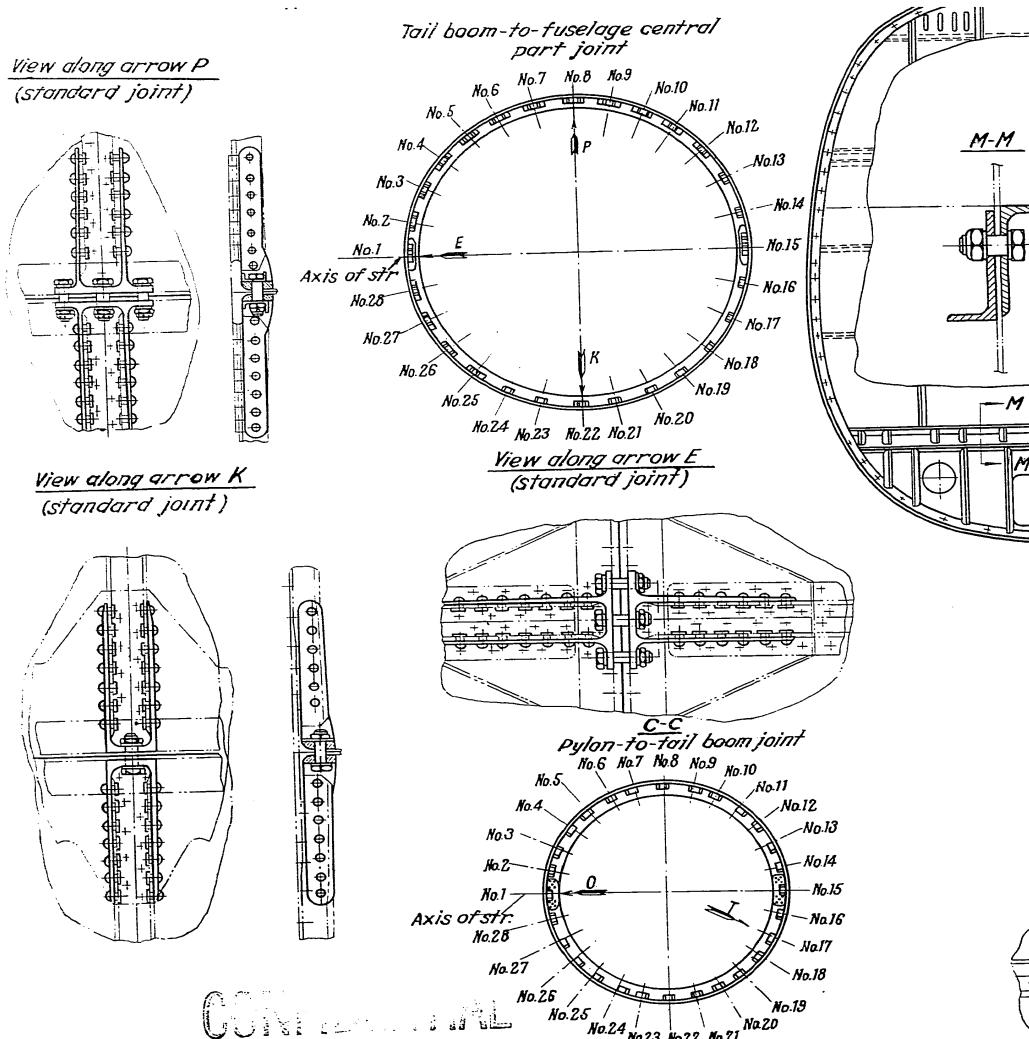


FIG. 76. DIAGRAM OF FUSELAGE JOINTS.

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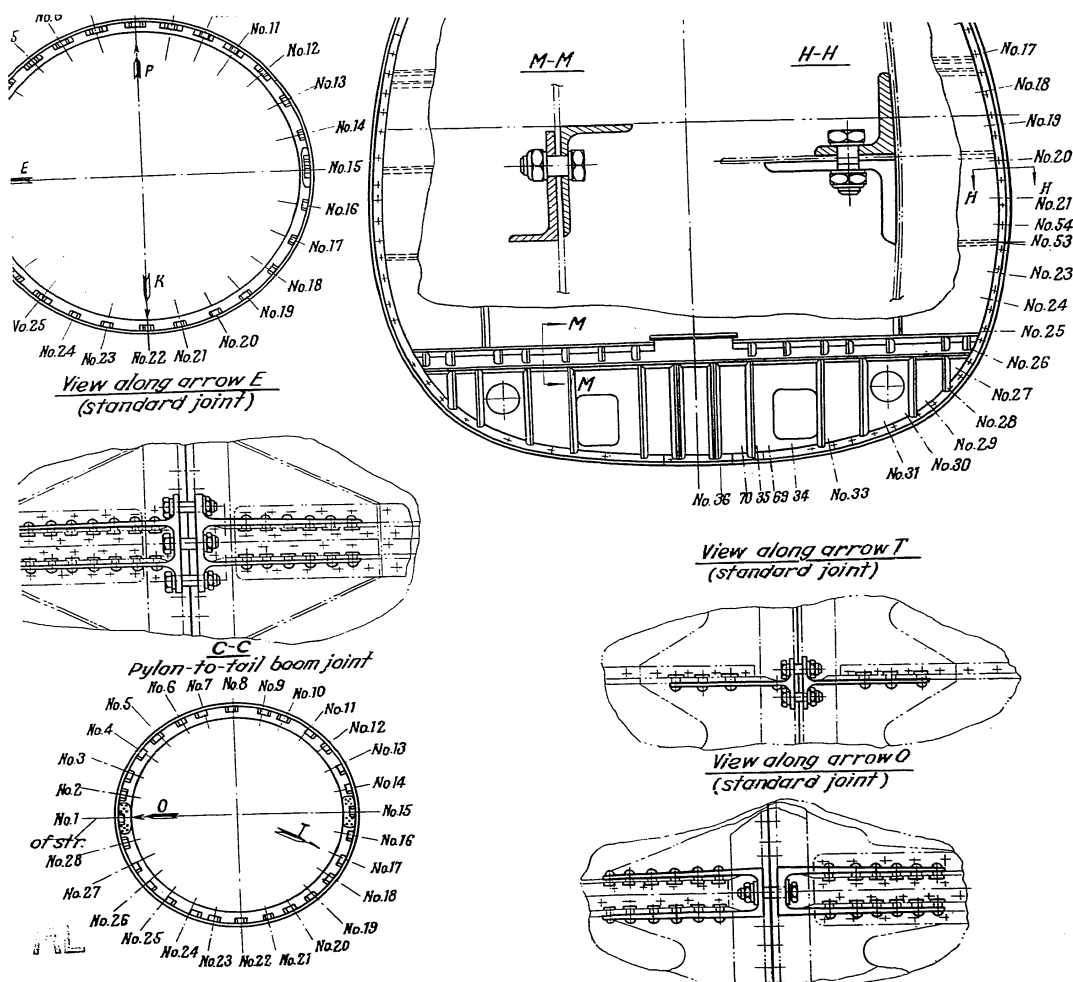


FIG. 76. DIAGRAM OF FUSELAGE JOINTS.

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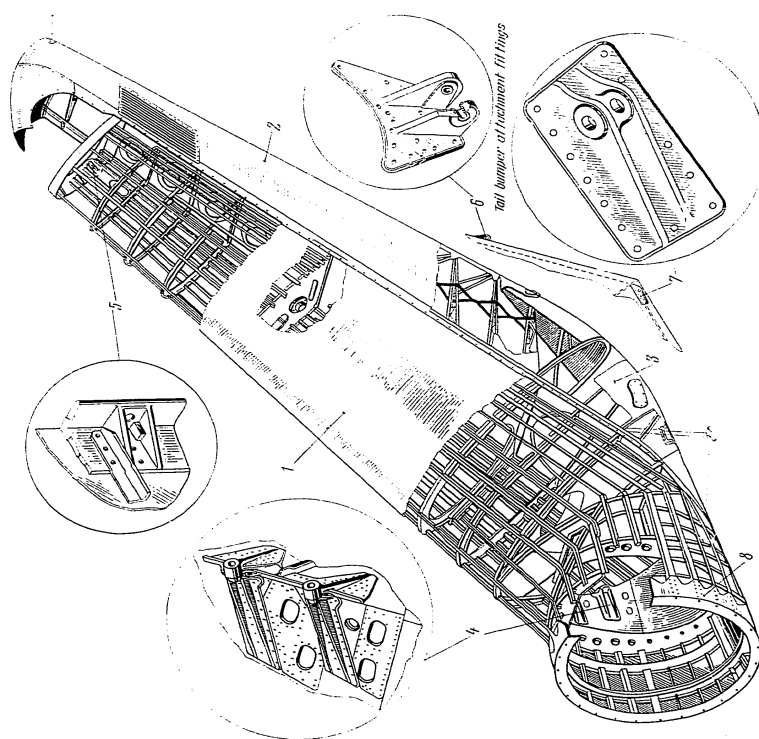


FIG. 1. PYLON
1—fin beam; 2—fixed rudder; 3—detachable fairing; 4—intermediate gear box attachment fitting; 5—end rib attachment fitting; 6—tail bumper shock strut attachment fitting; 7—tail bumper brace strut attachment fitting; 8—scalloped band.

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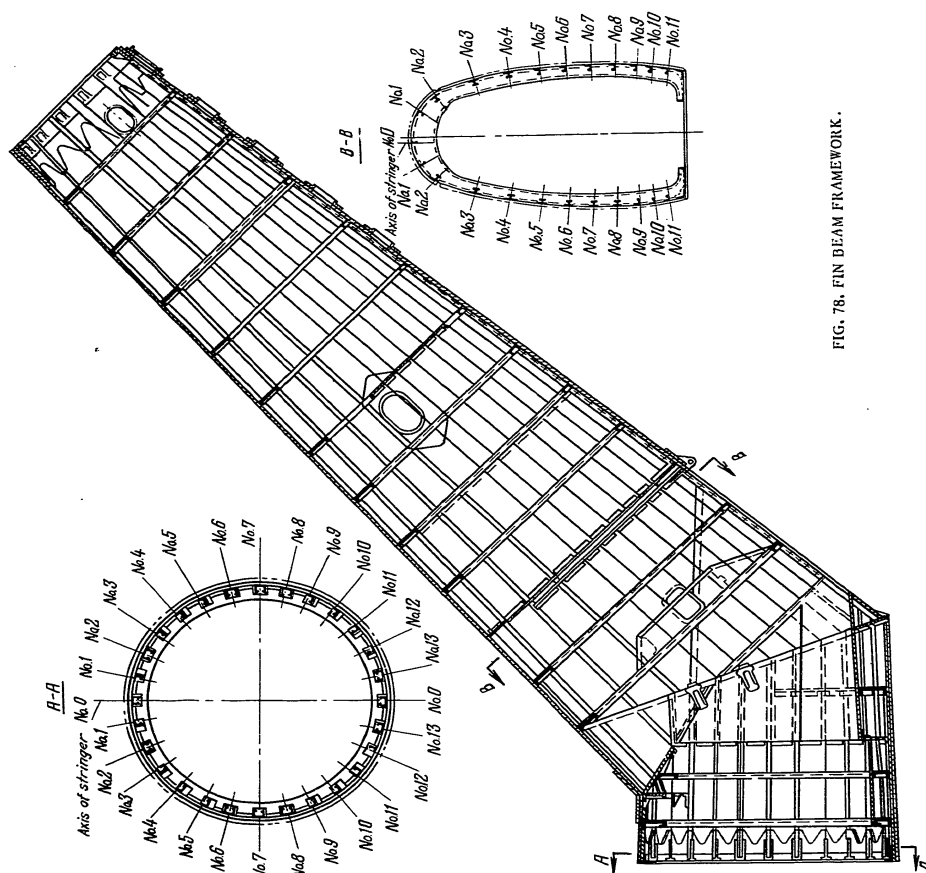


FIG. 78. FIN BEAM FRAMEWORK.

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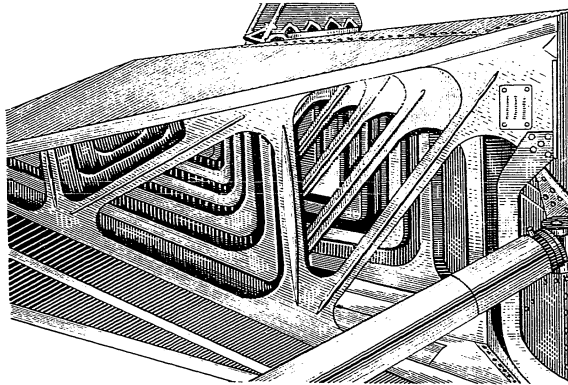


FIG. 80. FIXED RUDDER RIB STRESS-CARRYING FRAMEWORK AND TAIL BUMPER SHOCK STRUT ATTACHMENT FITTING.

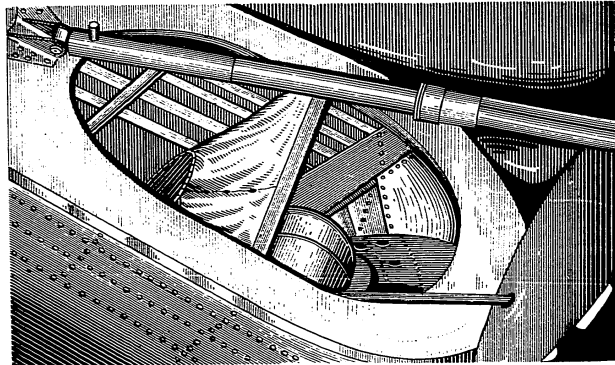


FIG. 79. HATCH GIVING ACCESS TO INTERMEDIATE GEAR BOX (with lower fairing removed).

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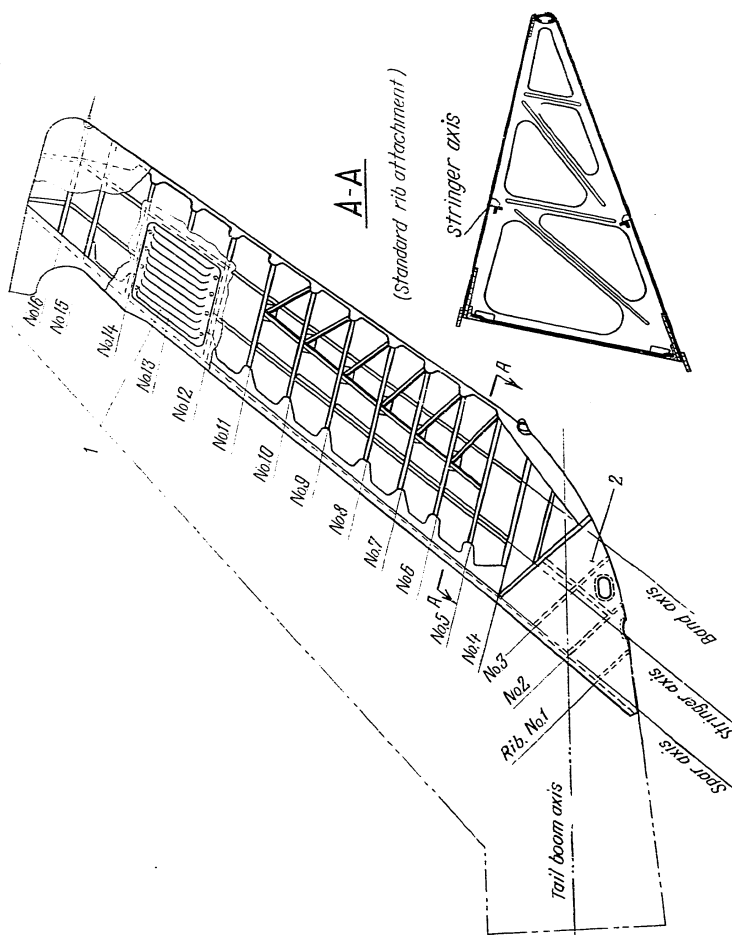


FIG. 81. FIXED RUDDER
1-ventilation flares; 2-detachable fitting.

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the skin outside with lentil-head rivets is a duralumin band bracing the fin beam just where the latter deflects upward.

The fin beam spar is made of sheet duralumin 116A-T 111.5. Held by rivets to the outer contour of the spar web are angle sections; besides, the web is additionally reinforced with sections riveted along its longitudinal axis.

An oval hole is made in the lower portion of the web to give access to the intermediate gear box (see Fig.79).

The tail bumper shock strut attachment fitting (Fig.80) is mounted on the spar along the centre line of rib No.4. Frame No.7 mounts four attachment fittings stamped from duralumin AK6; secured to these is the intermediate gear box.

In the vicinity of frames Nos 5 and 7 the fin beam is provided with an inner skin. Located outboard along stringers No 12 (left and right ^{one}) the stretch between frames Nos 6 and 7 are the attachment fittings of the tail bumper shock strut braces. These fittings are also made from AK6 duralumin stampings.

Secured with screws and self-locking nuts to the outer contour of the fin beam spar is the fixed rudder. The latter consists of thirteen ribs (Fig.81) stamped from sheet duralumin. The centre lines of the fin beam and fixed rudder ribs are inclined relative to each other, the ribs being jointed on the spar. The profile of the fixed rudder rib is asymmetrical.

The longitudinal framing of the fixed rudder is made up of extruded duralumin angles and crossing duralumin bands which increase the rigidity of the framing. On the tail rotor side, the rudder is faced with duralumin sheets secured in place with the aid of lentil-head rivets. The opposite side of the rudder is covered with fabric ACT-100 secured to the ribs. The seams are glued over with pinked percale type. After the fabric has been coated with dopes which ensure its proper tautness, the fabric is painted to match the colour of the helicopter.

Arranged in the upper part of the fixed rudder on its port side are louvres through which air is sucked off to cool the intermediate gear box.

The detachable fairing of the pylon is secured to the lower part of the fixed rudder and the contour of the spar external flange. The fairing is held in position with screws and self-locking nuts, being formed by a magnesium framework riveted to which is the MAB 111.2 sheet elektron skin. The fairing can be removed to give access to the intermediate gear box.

5. COWL

The helicopter features one common cowl for the engines, fan, and main gear box.

The cowl (Fig.82) consists of the following main parts: engine air intake ducts, front compartment, transverse and longitudinal fire bulkheads, middle, fan, and gear box compartments, and cowl end fairing. The hatches with hinged and removable doors ensure free access to the IB-I hydraulic assembly and the assemblies and units of the engines, main gear box, cooling fan, and other systems.

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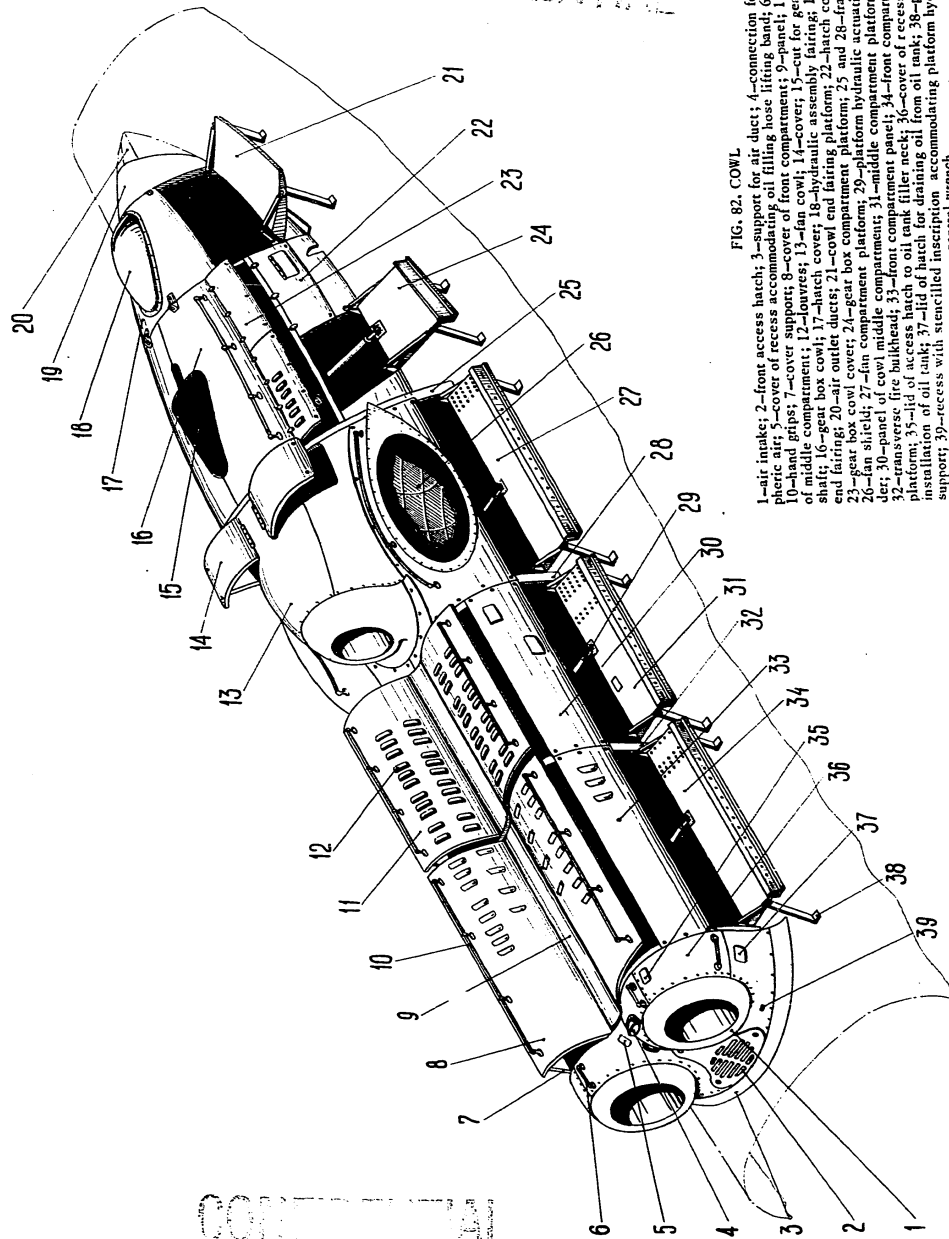


FIG. 82. COWL
 1—air intake; 2—front access hatch; 3—support for air duct; 4—connection for atmospheric air; 5—cover of recess accommodating oil filling hose lifting duct; 6—cover of middle compartment; 7—cover support; 8—cover of front compartment; 9—cover of middle compartment; 10—hand grips; 11—cover of front compartment; 12—louvers; 13—fan cowl; 14—cover; 15—cut for gear box shaft; 16—gear box cowl; 17—hatch cover; 18—hatch cover; 19—hatch cover; 20—air outlet duct; 21—air outlet duct; 22—hatch cover; 23—gear box cowl cover; 24—gear box cowl cover; 25—platform hydraulic actuating cylinder; 26—fan shield; 27—fan compartment panel; 28—middle compartment panel; 29—transverse fire bulkhead; 30—front compartment panel; 31—front compartment panel; 32—transverse fire bulkhead; 33—front compartment panel; 34—cover of recess for platform; 35—oil tank; 36—hatch for draining oil from oil tank; 37—lid of hatch for draining oil from oil tank; 38—platform support; 39—recess with stencilled inscription accommodating platform hydraulic control wrench.

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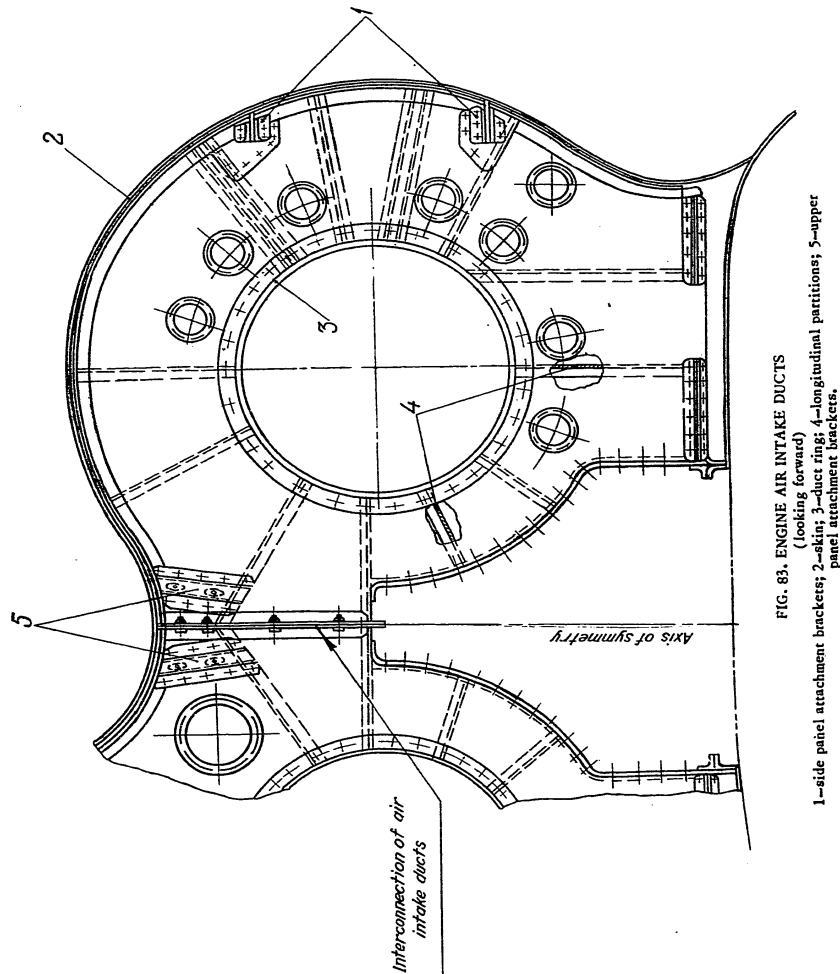


FIG. 83. ENGINE AIR INTAKE DUCTS (looking forward)

1—side panel attachment brackets; 2—skin; 3—duct ring; 4—longitudinal partitions; 5—upper panel attachment brackets.

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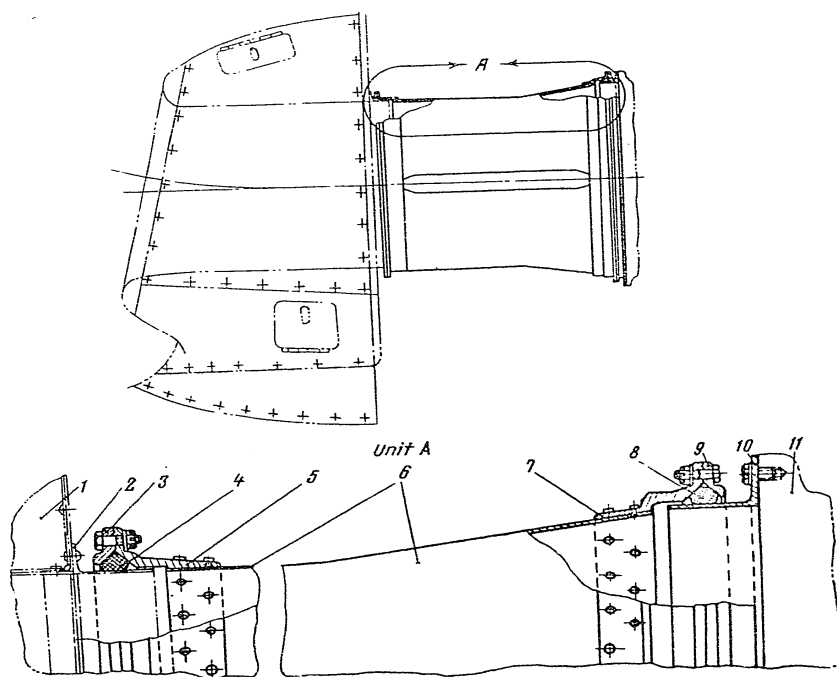


FIG. 84. ADAPTER

1 - air intake; 2 and 10 - rings; 3 and 9 - bracing rings; 4 and 8 - rubber sealing rings; 5 and 7 - shaped rings; 6 - shell; 11 - engine flange.

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the use of rubber rings ensures a flexible connection of the air intake to the engine. The connection must be flexible since, while in operation, the engine is liable to slight displacement with respect to its supports.

COWL FRONT COMPARTMENT

The cowl front compartment (see Fig.82) is located over the cold section of the engines between the engine air intake ducts and transverse fire bulkhead 32. The compartment is made up of two panels 33, panel 9, two covers 8, and two servicing platforms 34.

The outer skin of panels 33 is riveted to stamped stiffeners. Held by rivets to the upper edges of the panels are brackets (forks) for the cover clip pins, whereas the lower edges are provided with recesses for the servicing platform locks. To fasten panels 33 to the air intakes and the transverse fire bulkhead, use is made of brackets, screws, and anchor nuts.

Panel 9 is of a box section. It is made of a Π -shaped duralumin sheet with a skin riveted on top. Held to the panel bottom by rivets, too, is an angle section bar which serves for attaching the longitudinal fire bulkhead guard shields. Mounted on the vertical walls of the panel are brackets for the installation of covers.

Partitions are arranged inside the panel box at the points of bracket attachment. The panel is secured to the air intakes and the transverse fire bulkhead.

Covers 8 are comprised of stamped stiffeners and an outer skin riveted to them. Riveted to the lower edges of the covers are brackets. The cover locking clips are also mounted on the cover lower edges, whereas hand grips 10 are arranged on the outer skin. The cover is attached with the aid of three brackets. When in an open position, it is fixed with hinged supports thus ensuring access to the engine upper components and the D.C. generators.

SERVICING PLATFORMS

Servicing platforms 21, 24, 27, 31, and 34 (see Fig.82) of all the compartments are similar in design. They consist of a framework and outer and inner skin sheets. Supports 38 are mounted on the platform faces, whereas the platform lock mechanisms are positioned inside the platform between the skin sheets. Each platform is secured with the help of three brackets. The end compartment platform constitutes an exception, being attached on two brackets fixed to the fuselage skin. This platform is actuated by a hydraulic cylinder whose rod is hinged to a two-arm lever mounted on the platform bracket (see Fig.85).

The locks can be opened and the platforms set in working position both hydraulically and manually.

The servicing platform locks are opened by the hydraulic cylinder in the following way (see Figs 85 and 86): as cylinder rod 1 is extended, two-arm lever 2 turns as rest 4 permits it, thus displacing rod 3. The latter moves axially, actuating the relevant linkage and bringing latch 5 out of mesh. After lever 2 is stopped

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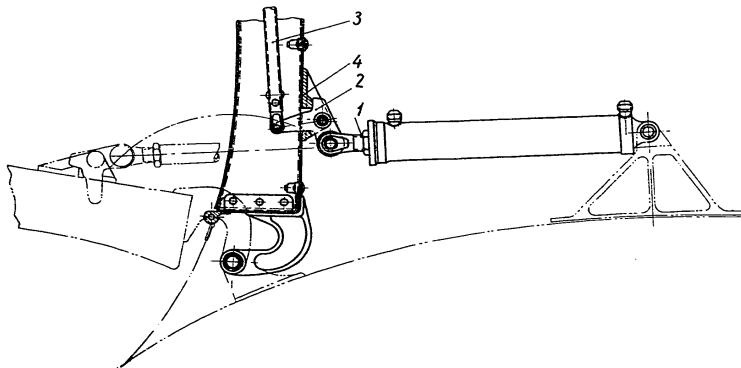


FIG.85. PLATFORM AND LOCK OPENING MECHANISM
1 - hydraulic cylinder rod; 2 - two-arm lever; 3 - lock opening rod; 4 - rest.

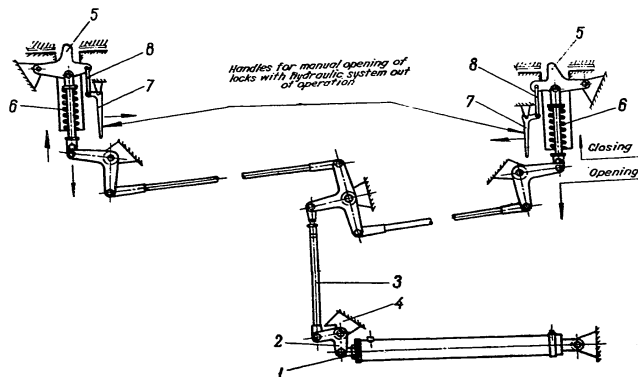


FIG.86. DIAGRAM OF PLATFORM LOCK CONTROL SYSTEM
1 - hydraulic cylinder rod; 2 - two-arm lever; 3 - rod; 4 - rest; 5 - latch; 6 - spring; 7 - two-arm lever for opening platform locks manually; 8 - shackle.

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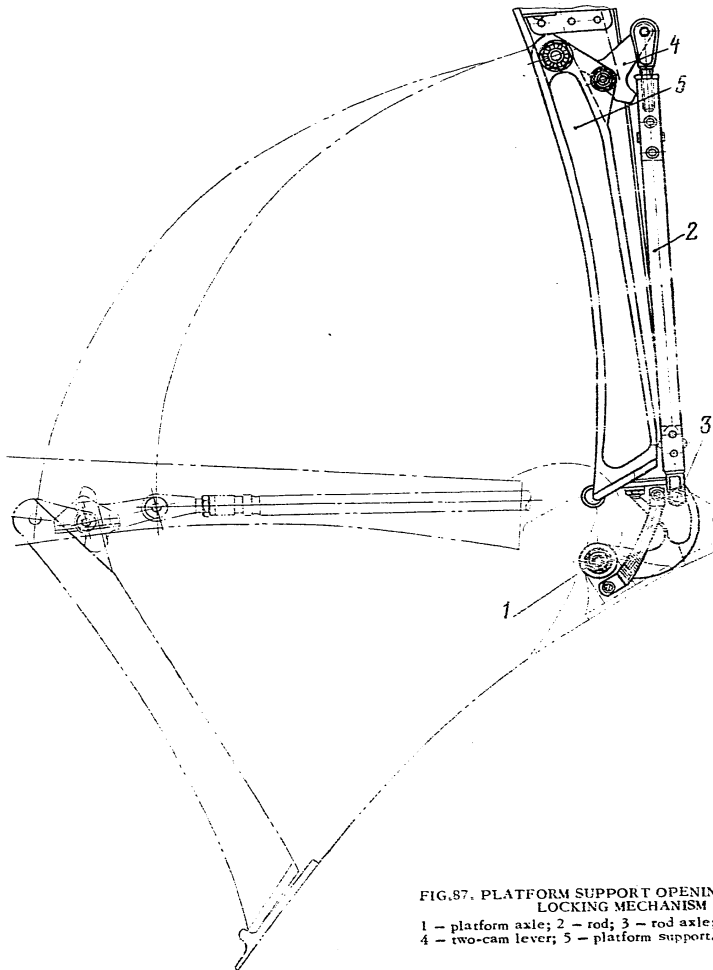


FIG. 87. PLATFORM SUPPORT OPENING AND
LOCKING MECHANISM
1 - platform axle; 2 - rod; 3 - rod axle;
4 - two-cam lever; 5 - platform support.

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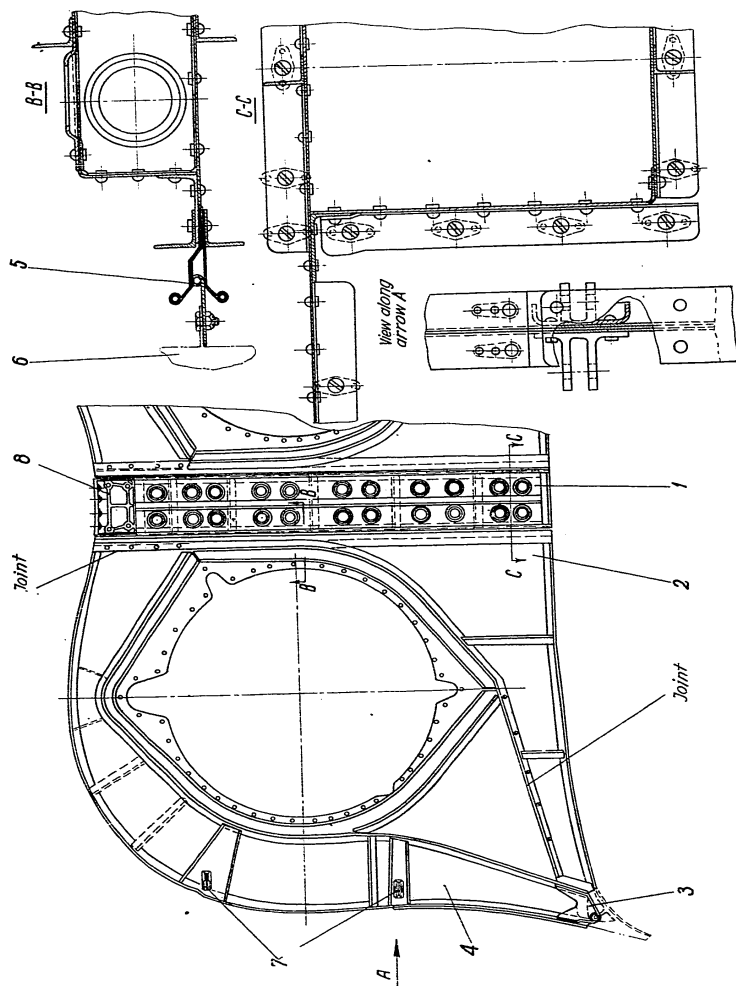


FIG.88. TRANSVERSE FIRE BULKHEAD
 1 - upright; 2 - lower (non-detachable) portion of fire bulkhead; 3 - bulkhead-to-fuselage attachment fitting; 4 - upper (detachable) portion of fire bulkhead; 5 - fork-shaped sealing; 6 - engine flange; 7 - side panel attachment brackets; 8 - upper panel attachment bracket.

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Secured to the engine flange is a sealing edging which, when assembled, enters fork-shaped sealing 5 of the fire bulkhead to seal the joint.

LONGITUDINAL FIRE BULKHEAD

The longitudinal fire bulkhead (Fig.89) separates the starboard engine from the port side one and is arranged along the helicopter axis between the rear wall of the air intake ducts and the fan shield. In height, it covers the distance from the fuselage ceiling to the upper panels of the cowl.

For the sake of convenience, the bulkhead is composed of two walls 3 and 4 and five detachable guard shields I, II, III, IV, and V, three of which are located in the front compartment, and two, in the middle compartment.

The guard shields are welded of sheet titanium, grade BT1, and include, constructionally, a set of sections and double skin 1. For rigidity purposes, both skin sheets are provided with mutually perpendicular beads, being interconnected by spot electric welding.

Welded to the lower faces of the guard shields are goffered guide sections. Mounted on hinged plates in the top portions of the shields are screw locks 9 securing the shields to section 11 that is riveted to the upper middle panel of the cowl.

The shield middle portions are interconnected by locks 8. The space between the shields is sealed with rubber sealing 12, whereas sealing at the top is accomplished through use of a rubber gasket cemented to section 11. Installation and removal of the guard shields are facilitated by handles 2.

Front wall 3 and rear wall 4 are made from titanium partitions and skin sheets held together by spot electric welding. The front wall is riveted to the ceiling, whereas the rear one is secured to it by bolts and self-locking nuts.

The rear wall has recess 5 for the starboard engine oil scavenging pump. Both sides of the walls are coated with heat-resistant filler BML-4.

COWL MIDDLE COMPARTMENT

The cowl middle compartment (see Fig.82) is located over the hot sections of the engines between the transverse fire bulkhead and the fan cowl and consists of two panels 30, two covers 11, panel 9, and two servicing platforms 31. The panels, covers, and platforms of the middle compartment are similar in design with those of the front compartment.

Secured to covers 11 are hand grips. Each panel 30 is provided with two footsteps protected with hinged covers.

The middle compartment panels are fitted with special brackets by means of which they are held to the transverse fire bulkhead and to the cowl middle compartment frame with the aid of screws and anchor nuts.

The frame of the middle compartment (Fig.90) is a riveted box structure consisting of two arches 1 and middle strut 2 with branches.

The arch portion of the frame is of a split design, the two parts being interconnected with the aid of fittings and bolts.

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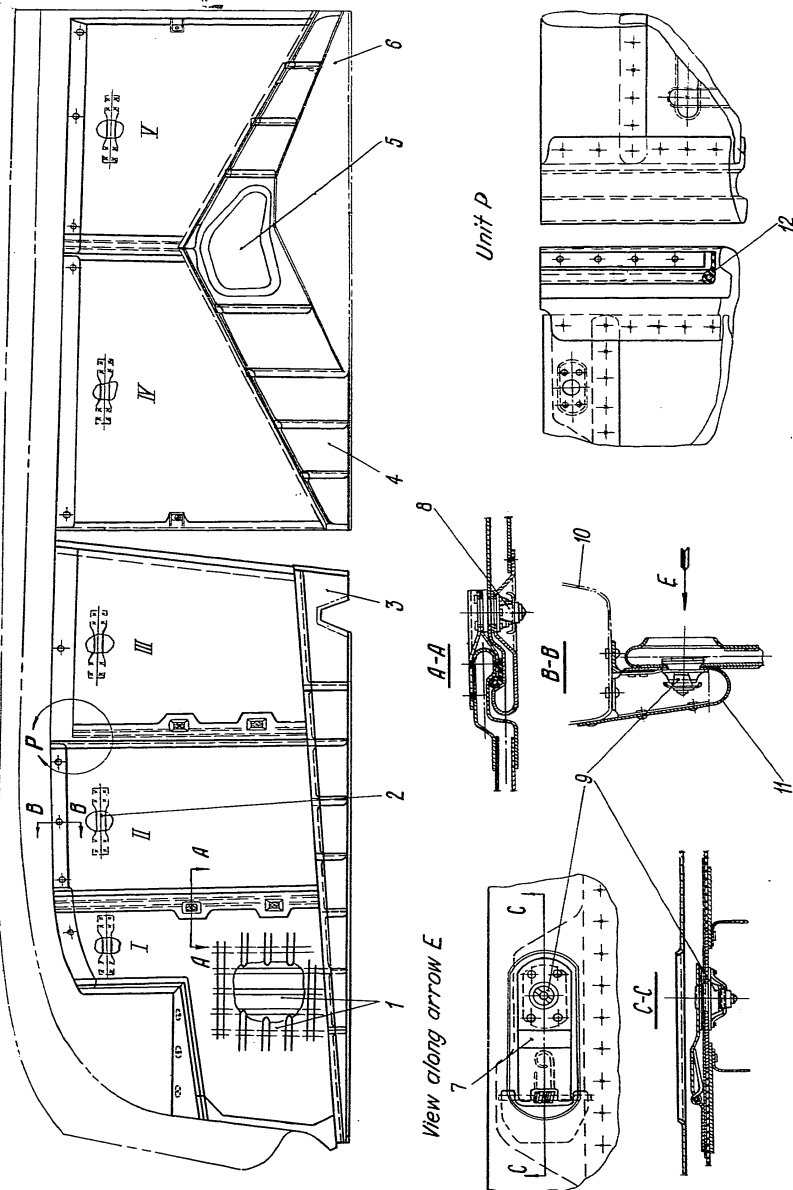


FIG. 89. LONGITUDINAL FIRE BULKHEAD
 1 - skin sheets with mutually perpendicular beads; 2 - guard shield handle; 3 - front wall; 4 - rear wall; 5 - recess; 6 - engine attachment unit pyramid skin; 7 - hinged plate with lock; 8 - lower lock; 9 - upper lock; 10 - upper cowd panel; 11 - section; 12 - rubber sealing.

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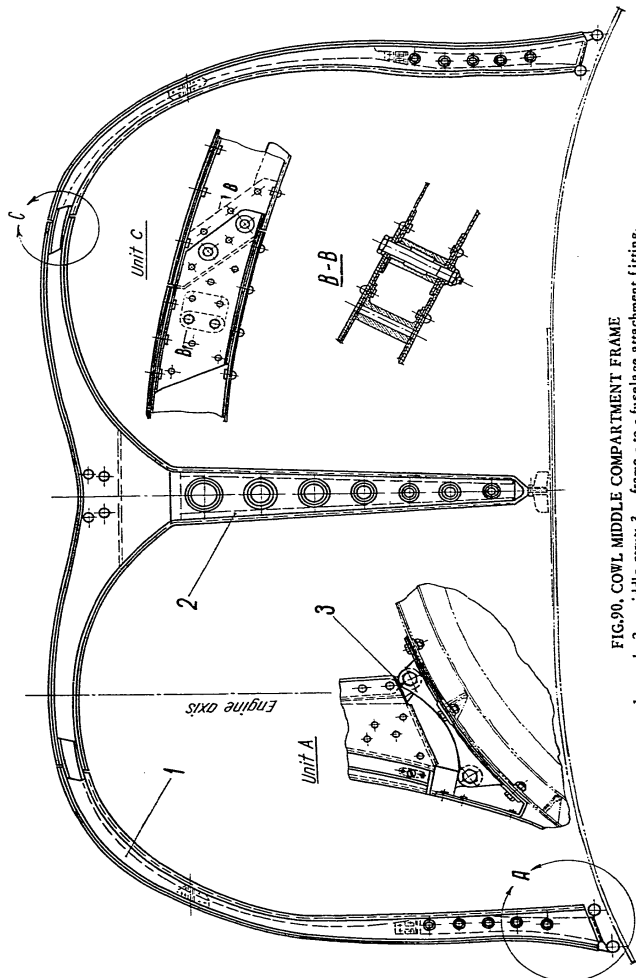


FIG.90, COWL MIDDLE COMPARTMENT FRAME
1 - arch; 2 - middle strut; 3 - frame - to - fuselage attachment fitting.

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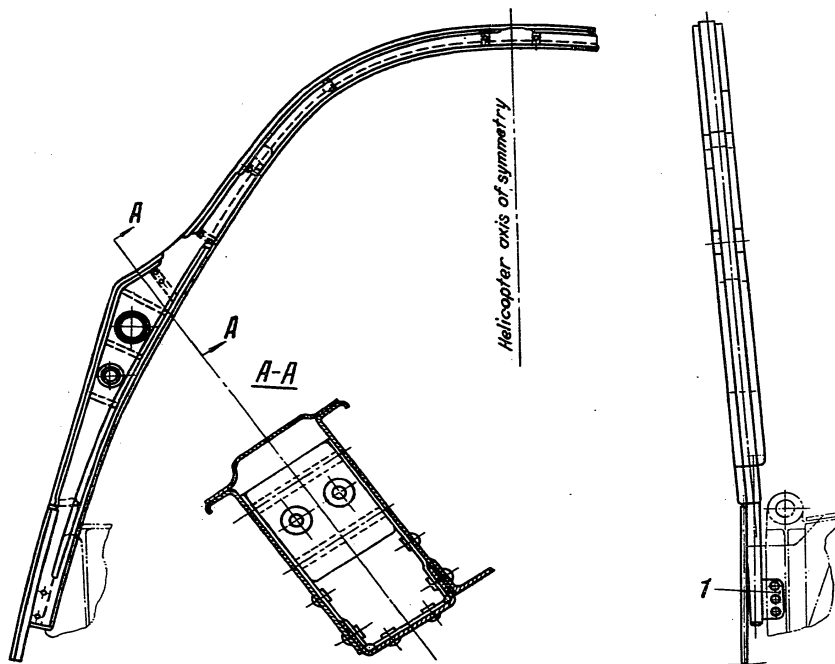


FIG.91. FRAME OF COWL FAN COMPARTMENT
1 - bracket.

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brace strut with asbestos gasket 7 fitted in along the cut contour. The box is fastened to the shield with screws and self-locking nuts.

The pipelines of the air, fire-extinguishing, and oil systems, as well as the pipelines for supply of cooling air to the generators are provided with flanged adapters at the joints. The flanges of these adapters overlap the cuts made in the fan shield panels for passing the pipelines through them.

The fan shield is coated on both sides with heat-resistant filler BUI-4.

GEAR BOX COWL

Gear box cowl 16 (see Fig.82) is located above the main gear box between the fan cowl and the end fairing. The cowl consists of an upper panel with a cut for the gear box shaft, four upper covers, two beams, two lower covers, and two servicing platforms.

The upper panel of cowl 16 is of riveted construction. It comprises a transverse and a longitudinal framings, made up of sections, and skin sheets.

Riveted to the longitudinal lower sections are hinges for attaching upper covers 23. Secured to the skin of the upper hinge are hand grips.

Covers 22 and 23 are composed of inner stamped stiffeners and outer skin sheets riveted to the stiffeners. Louvres are made in the skin of the front upper cover for cooling the under-cowl space. The covers are secured on special hinges and attached to the beam with the aid of screw locks.

The hatches protected by the covers and servicing platforms provide access for inspection of the main gear box, boosters, pipelines, and other assemblies.

END FAIRING

End fairing 19 (see Fig.82) is a continuation of the cowl representing the latter's rearmost portion. The riveted structure of the fairing includes transverse and longitudinal sections and skin sheets; located in the rear portion of the fairing are two ducts 20 for letting the fan-driven air out of the gear box.

Cover 17 facilitates servicing the hydraulic assembly. Located on both sides of the fairing are platforms 21.

The end fairing is secured to the fuselage by screws and anchor nuts, and the fairing frame, with the aid of brackets.

Arranged on the end fairing starboard is a recess with a hatch for the band by means of which the fuel servicing gun and its hose are lifted from the ground.

6. TROOP-CARRYING EQUIPMENT (25)

The seats (see Fig.93) for sixty-five troopers are arranged on either side of the helicopter cargo compartment and on the cargo compartment floor along the helicopter fore-and-aft axis.

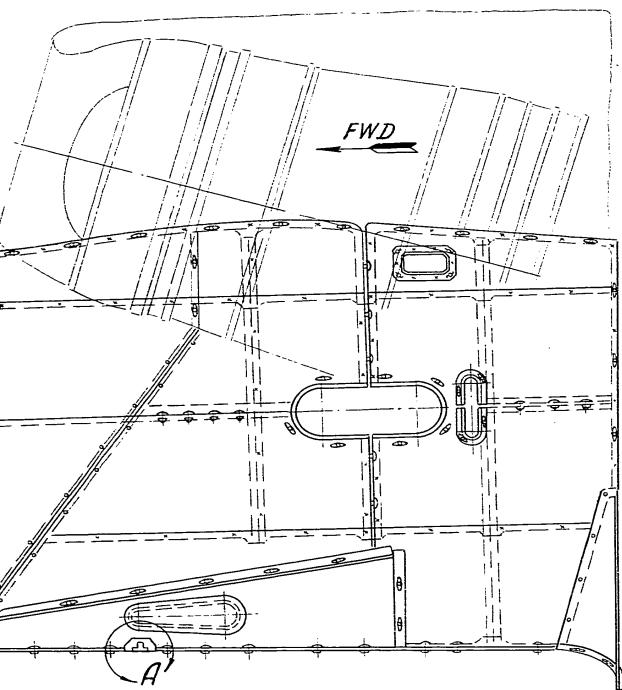
Located along the side walls of the compartment are ten single seats (Fig.40) and seven seats for three troopers each (Figs 94 and 95). Three seats for six troopers and two seats for eight troopers each (Figs 96 and 97) are arranged in the middle of the cargo compartment along its centre line.

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Unit A

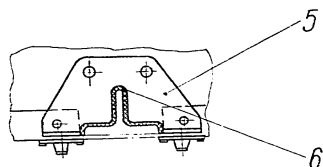
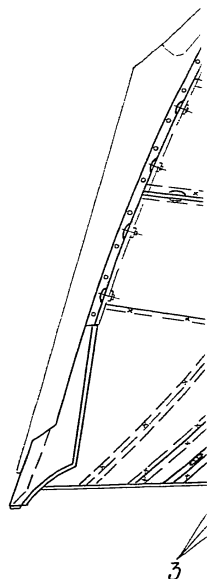


FIG.92. FAN SHIELD

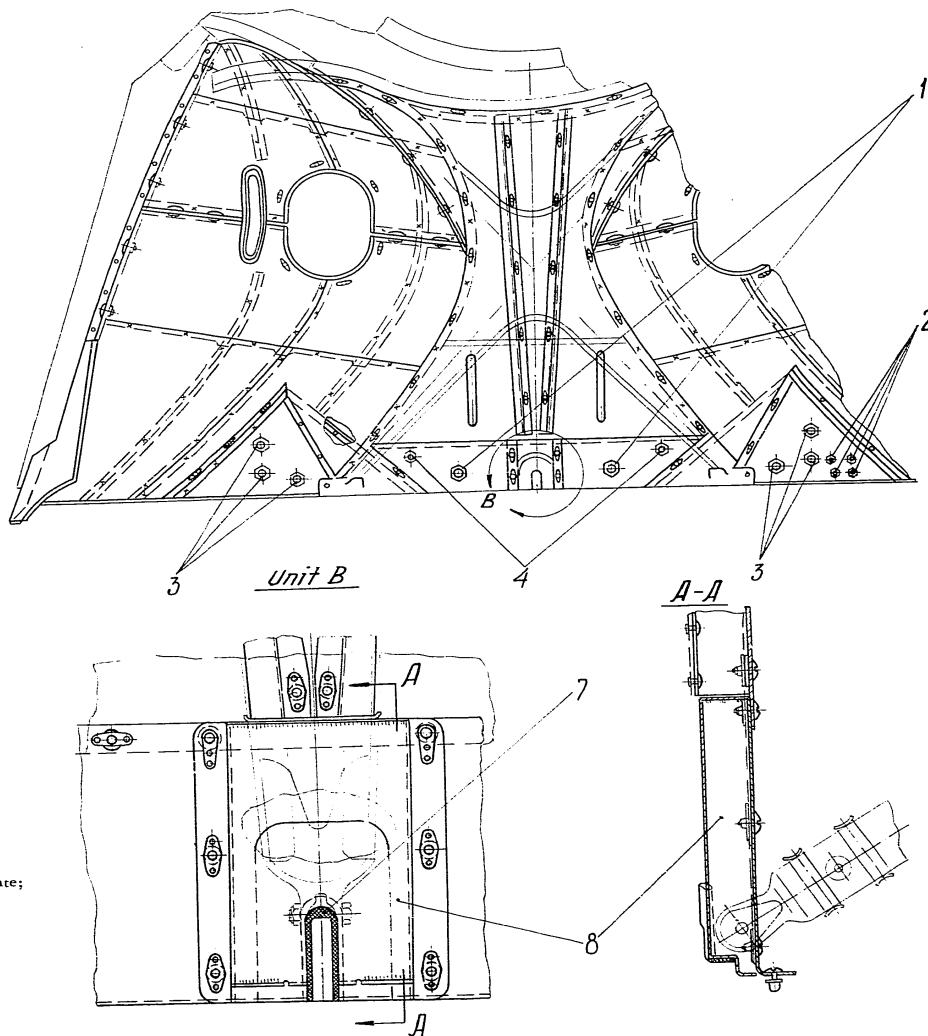
1 - pipelines for supply of cooling air to engine generators; 2 - pipelines of air system;
3 - pipelines of engine oil system; 4 - pipelines of fire-extinguishing system; 5 - cover plate;
6 and 7 - asbestos gasket; 8 - box.



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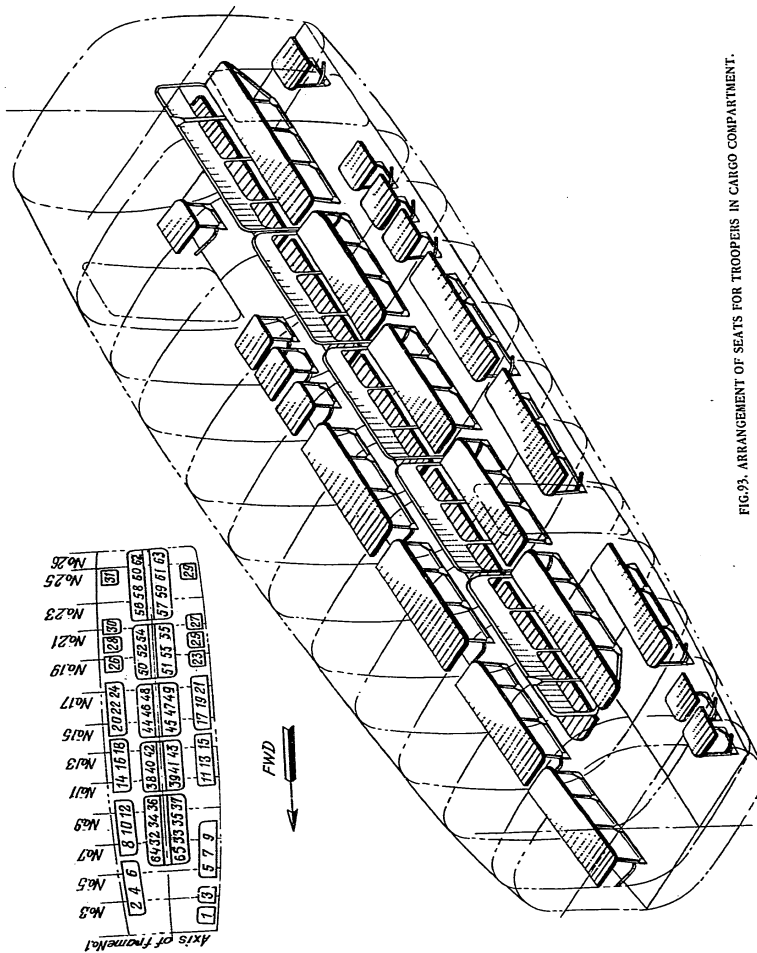


FIG. 93. ARRANGEMENT OF SEATS FOR TROOPERS IN CARGO COMPARTMENT.

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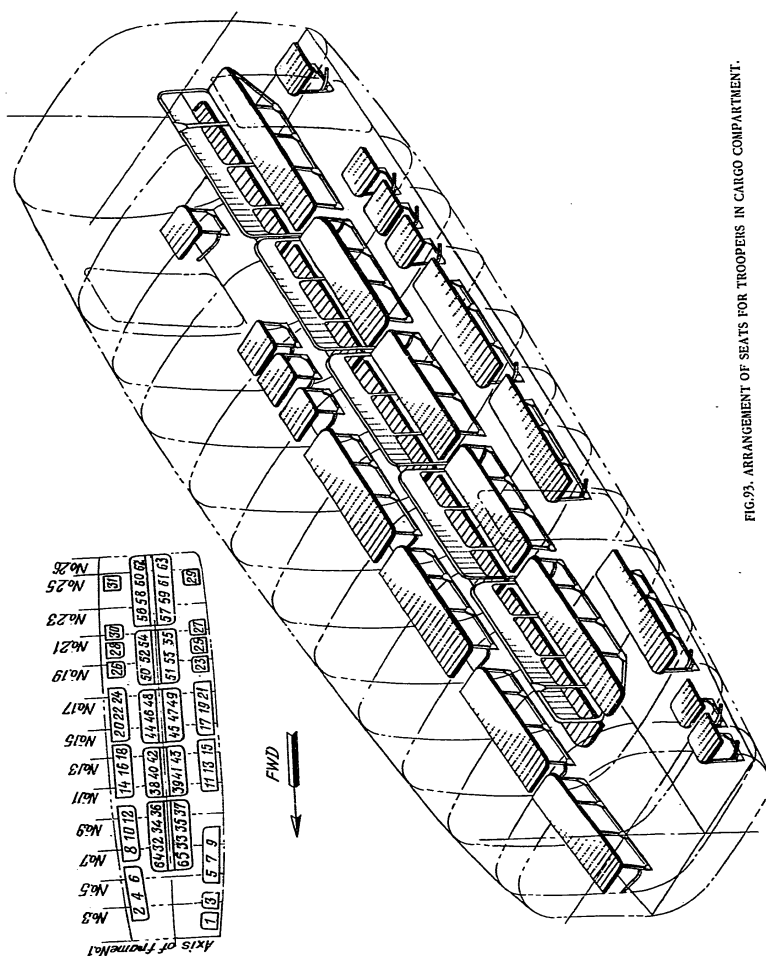


FIG.93. ARRANGEMENT OF SEATS FOR TROOPERS IN CARGO COMPARTMENT.

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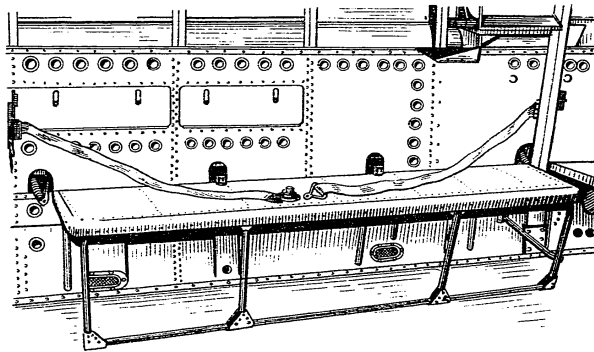


FIG.94. SEAT FOR THREE TROOPERS WITH SAFETY BELTS
(working position).

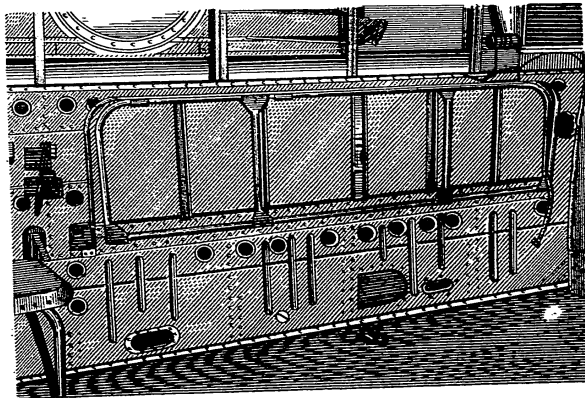


FIG.95. SEAT FOR THREE TROOPERS
(stowed position).

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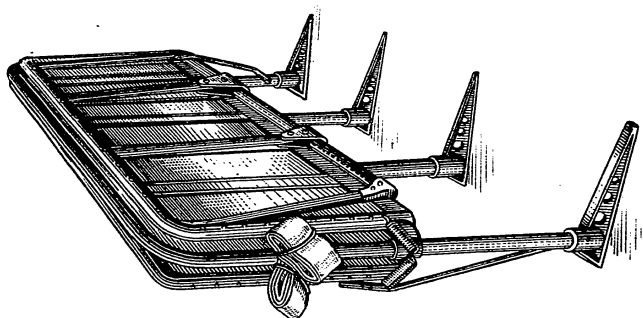


FIG.97 SEAT FOR SIX TROOPERS WITH SAFETY BELTS
(stowed position).

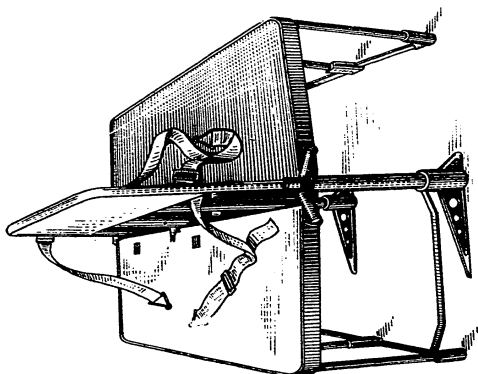


FIG.96 SEAT FOR SIX TROOPERS WITH SAFETY BELTS
(working position)

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The version for seating 65 men is a special one (the helicopter is normally intended for carrying sixty-one troopers). Four additional seats Nos 62, 63, 64, and 65 are obtained by replacing two seats for six troopers each with two seats for eight troopers each.

The seats located along the helicopter sides are of riveted construction: their panels are made from elektron MAB III and edged with elektron MAB-A15 stampings; riveted across the panel are duralumin bulb sections. One end of the seat is hinged in a bracket secured to the fuselage side; the other end rests on a frame fabricated from duralumin tubes. The frame is kinematically linked with the fuselage side and, as the seat is lifted or lowered, is automatically lifted or lowered, too. When in the stowed position, the seats are pressed by their springs to the fuselage side (see Fig.95).

The seats for six and eight troopers, secured to the cargo compartment floor, have a common vertical backrest formed by a bent tube covered with MAB III elektron sheets on both sides. Riveted to the tube ends are supporting brackets stamped from AK6 duralumin alloy. The brackets are attached to the floor with screws and self-locking nuts riveted to the floor covering.

The panels of these seats are similar in design with those of the side seats. When in the stowed position, the panels are also fixed with the aid of springs. The seat supporting frames are kinematically linked with the seat backrest tube just in the same way as the side seat frames.

All the seats for three and six troopers, as well as every three single seats are provided with safety belts common for three troopers. The seats for eight troopers feature safety belts common for every two men.

7. HEATING AND VENTILATION OF HELICOPTER CABINS AND CARGO COMPARTMENT

The helicopter features an air heating and ventilation system which serves to create normal conditions for the crew and the troopers airborne in the cargo compartment.

The heating system is a two-line type.

The air heated in the exhaust pipe shrouds is fed to the air-to-air heat exchangers and passes through the latter into the atmosphere. The air for cabin and cargo compartment heating is forced by the fan through the same heat exchangers, where it is warmed up and passed further into the helicopter cabins. In the heat exchangers the air for cabin heating and the hot air from the exhaust pipe shrouds flow via separate cavities which are not connected with each other. This guarantees cleanliness of the air supplied for heating the helicopter cabins and cargo compartment.

OPERATION OF HEATING AND VENTILATION SYSTEMS

Atmospheric air is forced by the main gear box fan (Fig.98) into cold air duct 6 that is separated into two branches: one branch takes the cold air to the ventilation system of the cargo compartment, whereas the other branch directs the sucked-in air to the exhaust pipe cooling shroud.

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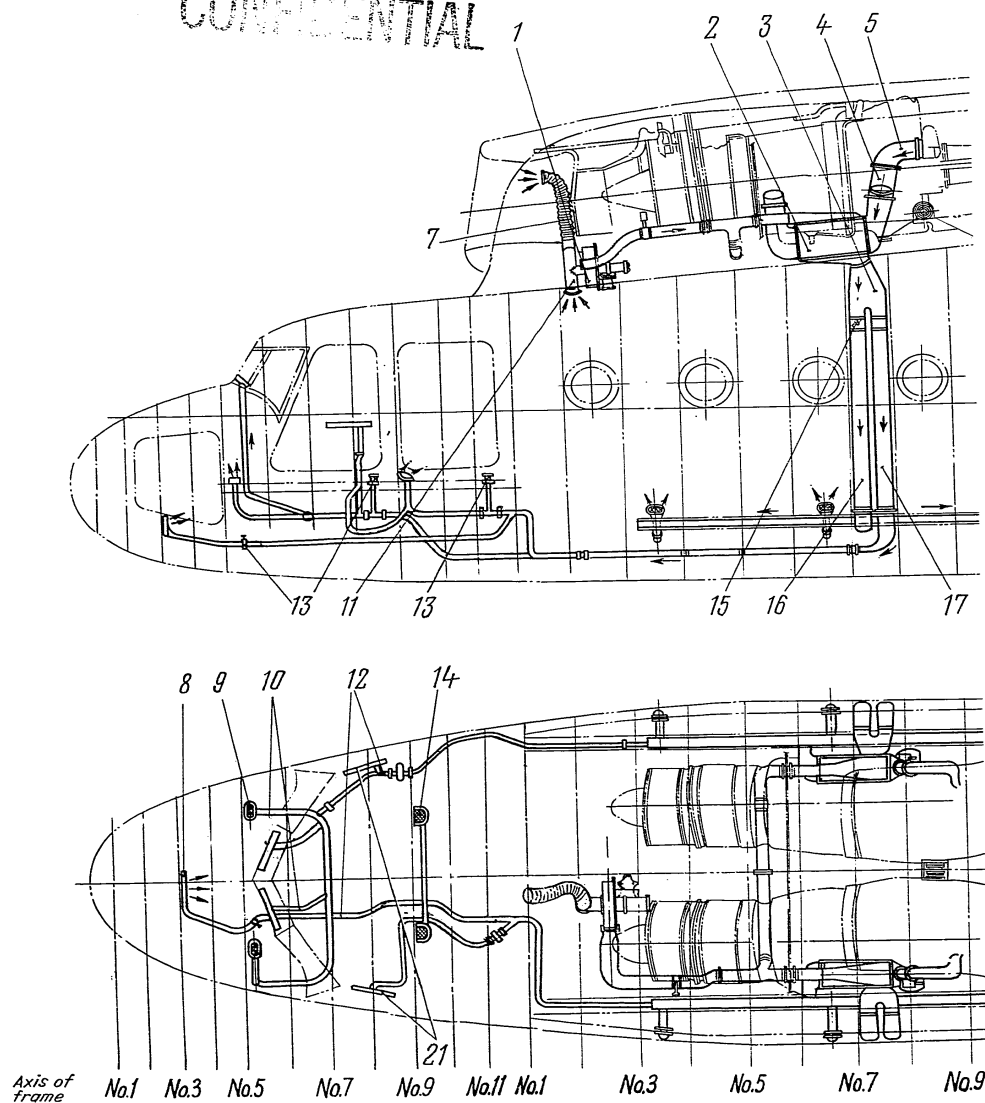


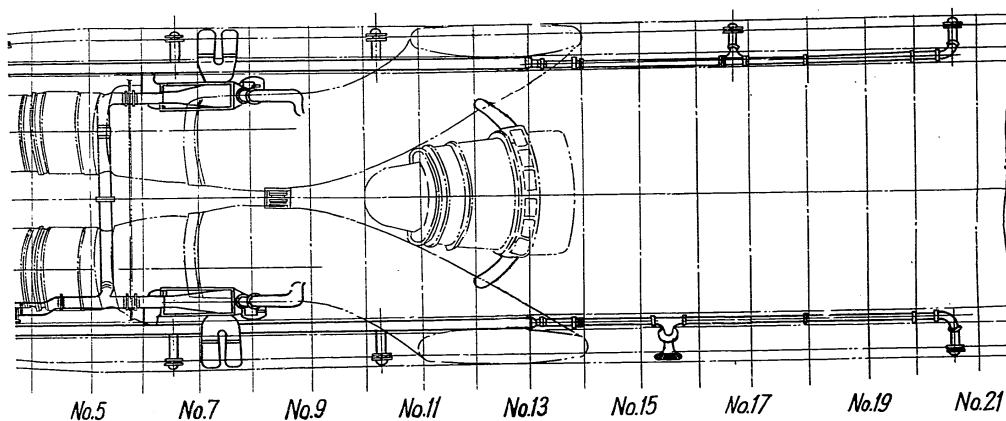
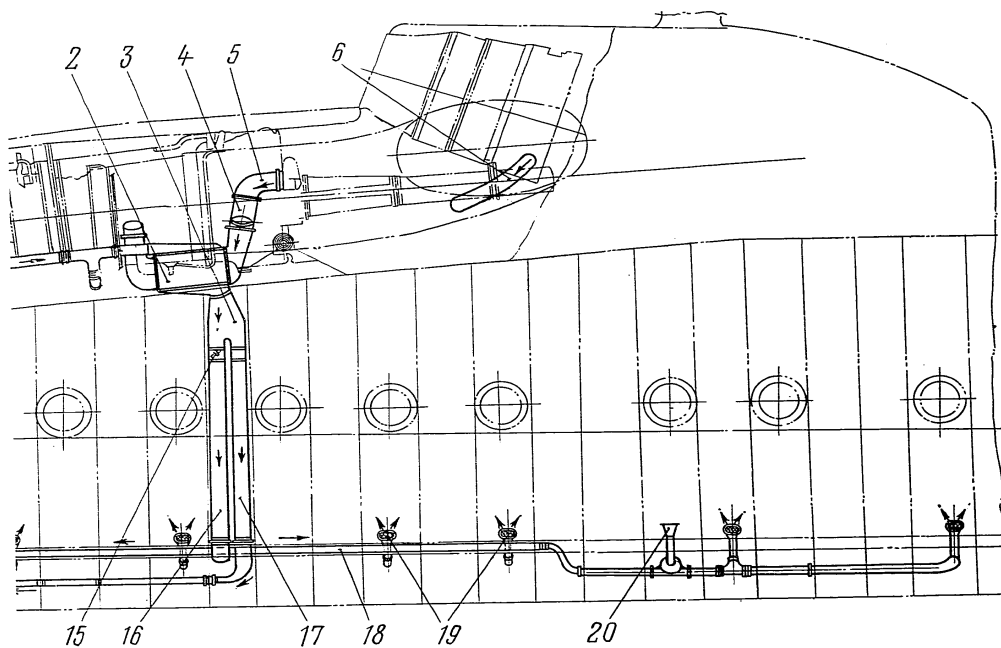
FIG. 98. HEATING AND VENTILATION SYSTEM OF HELICOPTER COMPARTMENT (7)

1 - fan; 2 - air-to-air heat exchanger; 3 - distributing duct; 4 - cold air duct; 5 - cold air outlet; 6 - cold air duct; 7 - fresh air intake pipe; 8 - warm air outlet air outlet in pilot's cabin; 9 - pipeline for supply of air to mid cabin; 10 - pipeline for supply of air to mid cabin; 11 - air intake from cargo compartment; 12 - pipelines for cabin; 13 - cabin hot air supply shutters; 14 - warm air outlet engineer's cabin; 15 - shutter; 16 - cargo compartment vertical cabin vertical heating duct; 17 - cargo compartment horizontal heating duct; 18 - cargo compartment horizontal heating duct; 19 - hot air outlet to air system sediment bowl; 20 - hot air outlet to air system sediment bowl; 21 - pipe

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D VENTILATION SYSTEM OF HELICOPTER CABINS AND CARGO COMPARTMENT(?)

heat exchanger; 3 - distributing duct; 4 - T-piece; 5 - hot air line; fresh air intake pipe; 8 - warm air outlet in navigator's cabin; 9 - warm bin; 10 - pipeline for supply of air to middle glass panels of pilots' from cargo compartment; 12 - pipelines for supply of hot air into crew's air supply shutters; 14 - warm air outlet in radio operator and flight shutter; 16 - cargo compartment vertical heating duct; 17 - crew's duct; 18 - cargo compartment horizontal heating duct; 19 - warm air inlet to air system sediment bowl; 21 - pipelines for air supply to blisters.

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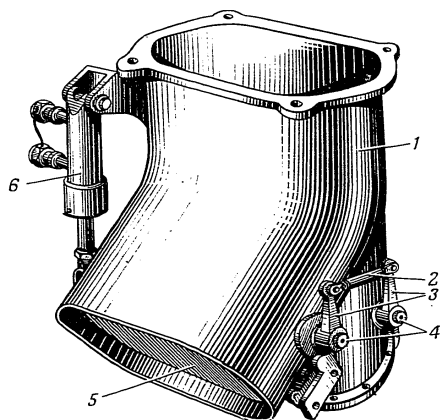


FIG. 99. T-PIECE (COMPLETE)
1 - body; 2 - rod; 3 - bell crank; 4 - shafts of shutters; 5 - shutter;
6 - pneumatic cylinder.

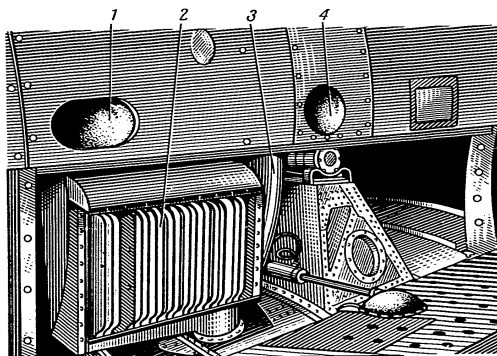


FIG. 100. AIR-TO-AIR HEAT EXCHANGER OF CABIN AND CARGO COMPARTMENT HEATING SYSTEM
1 - hot air outlet from heat exchanger; 2 - heat exchanger; 3 - hot air supply
4 - hot air outlet from T - piece into atmosphere.

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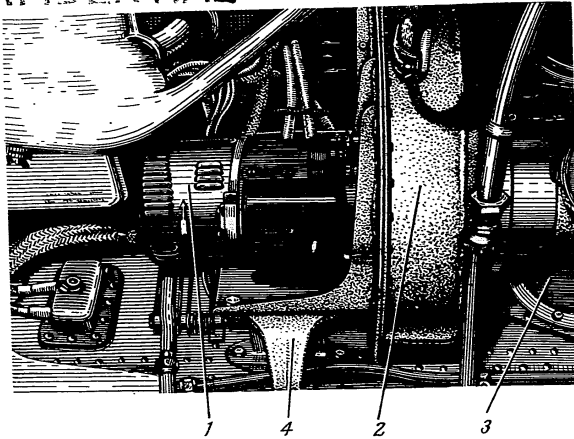


FIG. 101. HEATING AND VENTILATION SYSTEM FAN INSTALLED ON CARGO COMPARTMENT CEILING
1 - fan electric motor; 2 - fan; 3 - air intake from cargo compartment; 4 - fan attachment bracket.

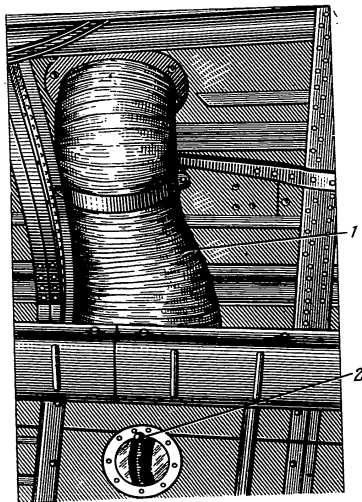


FIG. 102. CABIN HEATING SYSTEM DISTRIBUTING DUCT
1 - distributing duct; 2 - shutter control handle.

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In order to ensure better heating of the air and to improve heat transfer in the exhaust pipe shroud, the inner surfaces of the shrouds are provided with sections riveted to them in such a way as to form helical ducts directing the air flow around the exhaust pipes.

The hot air from the exhaust pipe shrouds is taken by pipeline 5 to T-pieces 4 located inboard on either side of the engine cowl middle compartment in the vicinity of frame No.8 of the fuselage central part. Thence the hot air is fed, depending on the position of the T-piece shutters, to air-to-air heat exchangers 2 or is let out into the atmosphere when heating is unnecessary.

The T-piece shutters (Fig.99) are remote-controlled from the pilots' cabin by operating a tumbler switch. The shutters are actuated by pneumatic cylinder 6 with the aid of rod 2 and bell cranks 3 mounted on shutter shafts 4.

With the heating system employed, the hot air flows through the heat exchanger, transfers part of its heat to the cold air, and escapes into the atmosphere.

The heat exchangers are arranged under the cowl on either side of the cargo compartment ceiling between frames Nos 6 and 8 (Fig.100).

The heat exchangers comprise two independent lines which are isolated from each other. Circulating in one line is the hot air, and in the other, the cold air.

The cold air is forced into the system by fan 1 (see Fig.98) mounted in the engine compartment (on the cargo compartment ceiling) between frames Nos 2 and 3 of the fuselage central part (Fig.101). The air is sucked in by the fan either from the cargo compartment or from the atmosphere, for which purpose a T-piece with a shutter is mounted in front of the fan. The shutter is remotely controlled with the aid of pneumatic cylinder. After the cold air has been warmed up in the heat exchanger, it enters distributing ducts 3 (see Fig.98) located on either side of the fuselage between frames Nos 7 and 8 of the fuselage central part.

The distributing duct (Fig.102) is, in turn, divided into two ducts (stand pipes). One of these stand pipes serves to supply warm air into the crew's cabins, and the other, to direct the air into the horizontal duct laid under the cargo compartment floor for heating the cargo compartment.

Cargo compartment vertical heating duct 16 (see Fig.98) is provided with shutter 15. The latter has a manual control handle by means of which it is possible to regulate the amount of warm air admitted into the compartment.

The cabin heating system is also used for ventilation purposes. In the latter case, the atmospheric air is sucked in through fresh air intake pipe 7 (see Fig.98) and forced by fan 1 into the cabins and cargo compartment, whereas the hot air from T-pieces 4 is let out into the atmosphere. The location of the fresh air intake pipe is shown in Fig.103.

HEATING AND VENTILATION OF CREW CABINS

The cabins for the helicopter crew are heated with warm air entering the cabins through holes 9 and 14 made in the duct flanges (Fig.98). These warm air outlets are located near the feed of the pilots, radio operator, and helicopter engineer. Warm air to the navigator's feet is admitted through outlet 8.

The amount of warm air supplied into the cabins may be regulated by the crew members through operation of handles 13 linked with the shutters and mounted behind the seats of the co-pilot, helicopter engineer and navigator.

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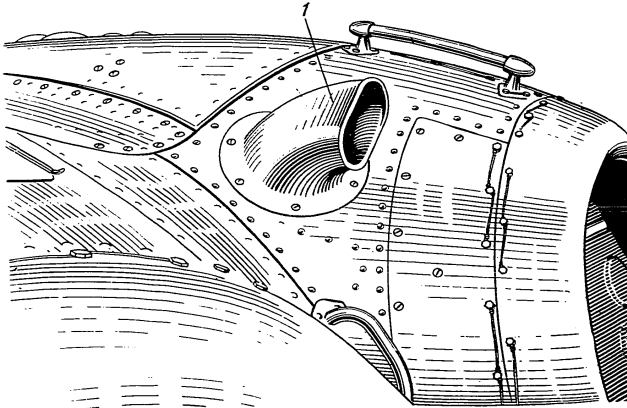


FIG. 103. FRESH AIR INTAKE PIPE CONNECTION
1 - air intake pipe connection.

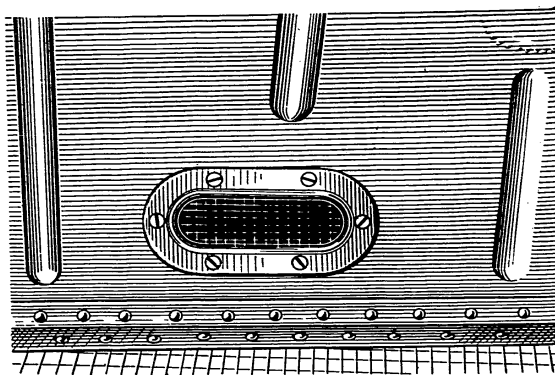


FIG. 104. WARM AIR OUTLET IN CARGO COMPARTMENT.

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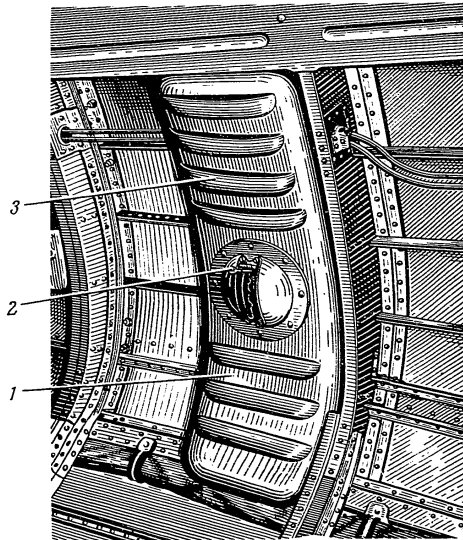


FIG.105. CARGO COMPARTMENT
VENTILATION SYSTEM
DUCT

1 - duct; 2 - ventilation shutter
control handle; 3 - louvers for sup-
ply of fresh air into cargo compart-
ment.

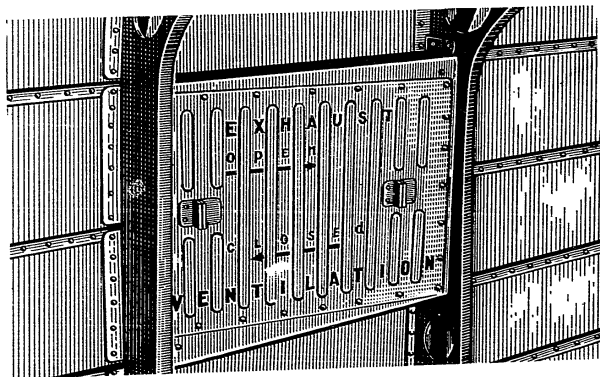


FIG.106. EXHAUST VENTILATION SHUTTER INSIDE CARGO COMPARTMENT.

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The navigator may regulate the amount of the warm air supplied independently of the other crew members.

The two front middle glass panels of the pilots' cabin are warmed by hot air delivered from the main heating line via pipelines 10.

The crew's cabin heating and ventilation system ducts are made from aluminum sheets. Heat losses are reduced by heat-insulating glass cotton АСНМ-5 applied to the ducts. The glass cotton is coated with fire-proof tape ЛАС.

HEATING AND VENTILATION OF CARGO COMPARTMENT

The cargo compartment is heated with warm air entering it via two horizontal ducts 18 (see Fig.98) located between frames Nos 3 and 21 and fitted with six outlets each.

The warm air is admitted into the compartment through holes 19 provided in the flanges of the outlets secured to the fuselage inner skin above the cargo compartment floor level. One outlet (Ref. No.20) is used for supply of warm air to the air system sediment bowl.

The location of the warm air outlets in the cargo compartment is shown in Figs 98 and 104.

The cargo compartment heating ducts are made in sheet aluminum Л16А-М, and their branches, in sheet aluminum АМЛ1А-И. To reduce heat losses, all the ducts are coated with glass cotton АСНМ-5 and fire-proof tape ЛАС.

The air from the gear box fan, passed for ventilation purposes into the cargo compartment, flows along the duct into the ventilation devices located on either side of the fuselage between frames Nos 12 and 13 and stringers Nos 7 and 8.

The cargo compartment ventilation system (see Fig.105) is provided with throttle valves making it possible to regulate the amount of air fed into the cargo compartment. The regulation is accomplished through use of handle 2 which may be fixed in five positions.

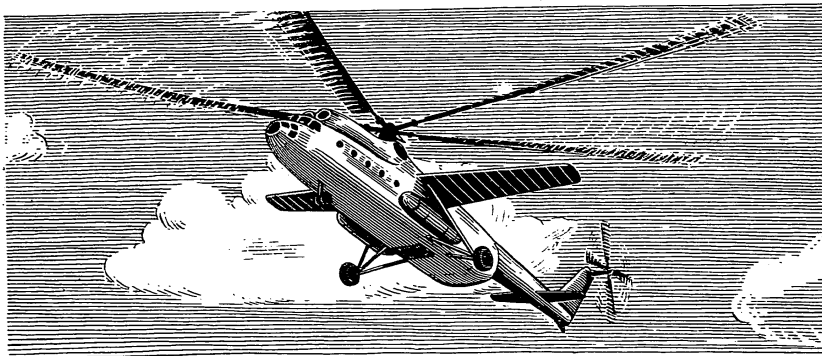
From the cargo compartment air is let out into the atmosphere through the vent holes located on the cargo compartment starboard door panel (see Fig.67). These holes are made in the form of louvres which can be blanked off from inside with a shutter (see Fig.106). The shutter is opened or closed manually by displacing it along its guides.

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Chapter II

WING AND STABILIZER

WING PURPOSE

The purpose of the wing is to off-load the main rotor. The main rotor off-loading results in a decrease of the dynamic and static stresses in the blades and in an increase of the maximum permissible flying speed as a function of the stalling conditions.

The helicopter wing is of the controllable type and may be fixed in two positions.

At all engine ratings in a powered flight, the wing is set for an angle of $+14^{\circ}15'$ with respect to the fuselage reference line (as measured for the port wing cantilever). With the main rotor beginning to operate at an autorotation duty, the wing setting angle is changed with the aid of the FMK-I mechanism to equal $+4^{\circ}15'$.

Due to the fact that the induced air flow from the main rotor is asymmetrical, the setting angle of the starboard wing cantilever is by 1.5° greater than that of the port cantilever.

The ends of the wing cantilevers carry 20-kg anti-flutter weights.

The wing is rated for a maximum load equal to 25 per cent of the helicopter flying weight. The theoretical profile of the wing is formed by airfoil H35 (HAIW). The relative thickness is 15 per cent at the wing root, and 12 per cent at the wing tip. The wing strong box (spar) centre line is located at 24% MAC.

WING CONSTRUCTION

The helicopter wing (Fig.107) is comprised of three parts: starboard and port cantilevers 6, symmetrically arranged with respect to the fuselage, and centre-plane beam 1.

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The wing has two main structural joints by means of which the wing cantilevers are connected to the centre-plane beam in the vicinity of rib No.5; the joints are flanged ones.

The cantilever is a riveted structure made up of a strong box performing the function of a spar, the leading edge portion, the trailing edge portion, and the tip (fairing).

The strong box is of riveted construction. It consists of a longitudinal set of stringers 20 reinforced by partitions that are arranged along the axes of even number ribs.

The strong box stringers are of varying length, thus ending at different ribs. Five stringers are located on the strong box upper panel, and as many, on the lower one, stretching from rib No.5 to rib No.18. Four stringers are run on each panel from rib No.18 to rib No.26, three stringers, from rib No.26 to rib No.28, and two stringers, from rib No.28 to rib No.32.

The strong box front wall is composed of duralumin sheets 4, 2, 1.5, and 1 mm thick; the sheet thickness drops off towards the wing tip. At ribs Nos 7, 15, and 23 the sheets are overlapped. The rear wall of the strong box is constructionally identical with the front wall. It is made up of AI6A-T sheets of the same thicknesses. The sheet joints are located at ribs Nos 7, 16, and 24.

The upper and lower skin sheets of the strong box are made from duralumin 4, 2, and 1 mm thick. The sheet thickness reduces towards the wing tip. The sheets are overlapped.

The wing leading edge comprises a set of nose ribs, made from AI6A-T AI duralumin sheets and reinforced by vertical duralumin sections, and stringers. Root nose rib No.5 is fabricated from AI6A-T AI.5 duralumin, and tip nose rib No.32, from AI6A-T AI2.0 duralumin (rib No.5 is 1.5 mm thick, and rib No.32, 2.0 mm thick).

The wing trailing edge consists of tail ribs 22 stamped from sheet duralumin and a set of stringers 23 formed by duralumin extruded angle bars.

The leading and trailing edges of the wing are faced with sheet duralumin.

To protect the wing portion subject to maximum heating by the exhaust gases, provision is made for a special shield mounted on angles; the latter are made from material whose heat conductance is very low. The shield is secured in place with screws and anchor nuts. The gap between the shield and the wing skin serves for passing of cold air.

Located on the cantilever top surfaces are recesses for installing formation lights. Besides, there are attachment fittings for the eye bolts used in lifting and lowering the wing during its installation and removal.

Centre-plane beam 2 (Figs 108 and 109) is of riveted construction, quadrangular in section, with the top and bottom walls made from the AI6A-T AI5 duralumin 5 mm thick; the walls are reinforced by stringers. The beam front and rear walls are AI6A-T AI4 duralumin sheets.

The walls are interconnected with longitudinal duralumin sections and reinforced by eight blind transverse partitions made from the AI6A-T AI2 duralumin.

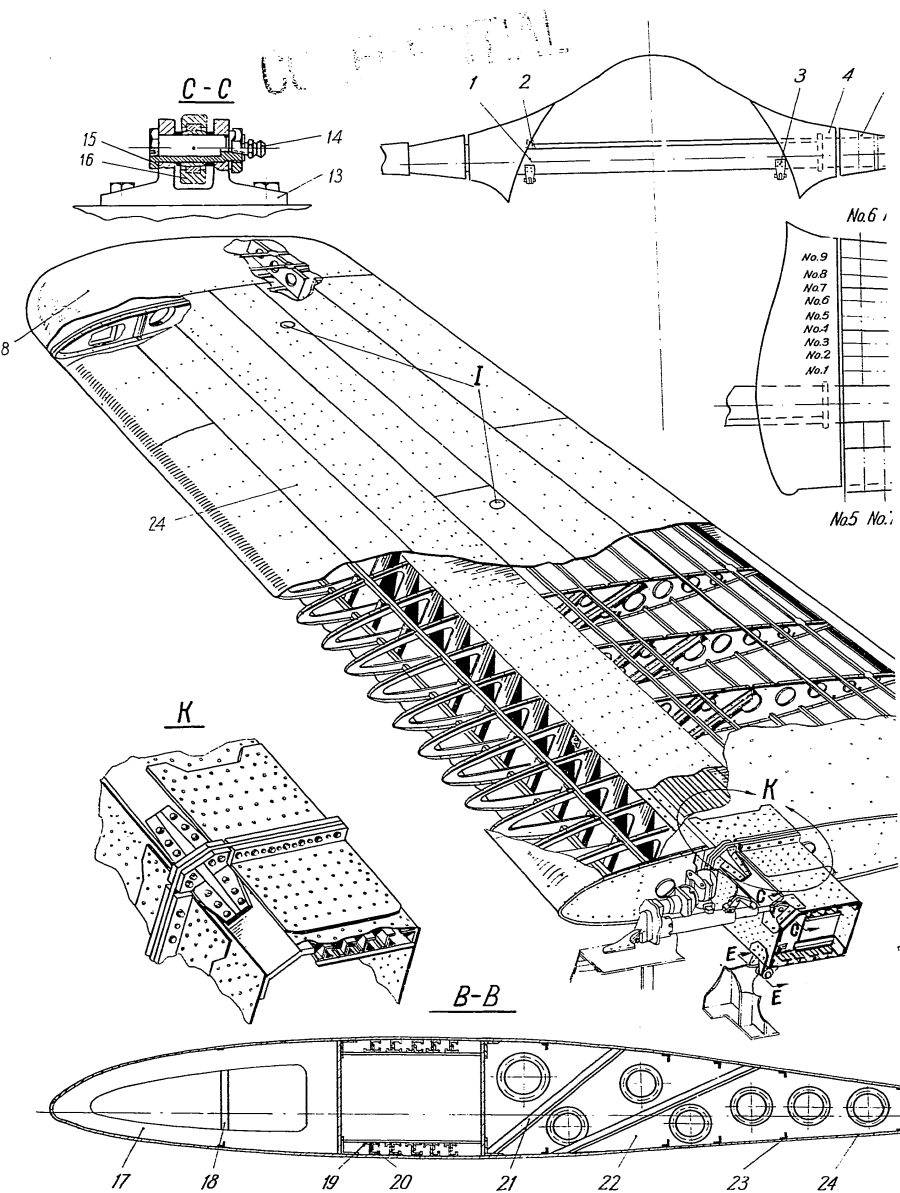
The beam is, in the main, a riveted structure; it is only in the places where access is difficult that its components are interconnected with screws and anchor nuts.

Located on the beam bottom near the front wall are two attachment fittings for suspension of the wing. One attachment fitting for the rod of the TMK-I wing hydraulic control mechanism is located on the beam top.

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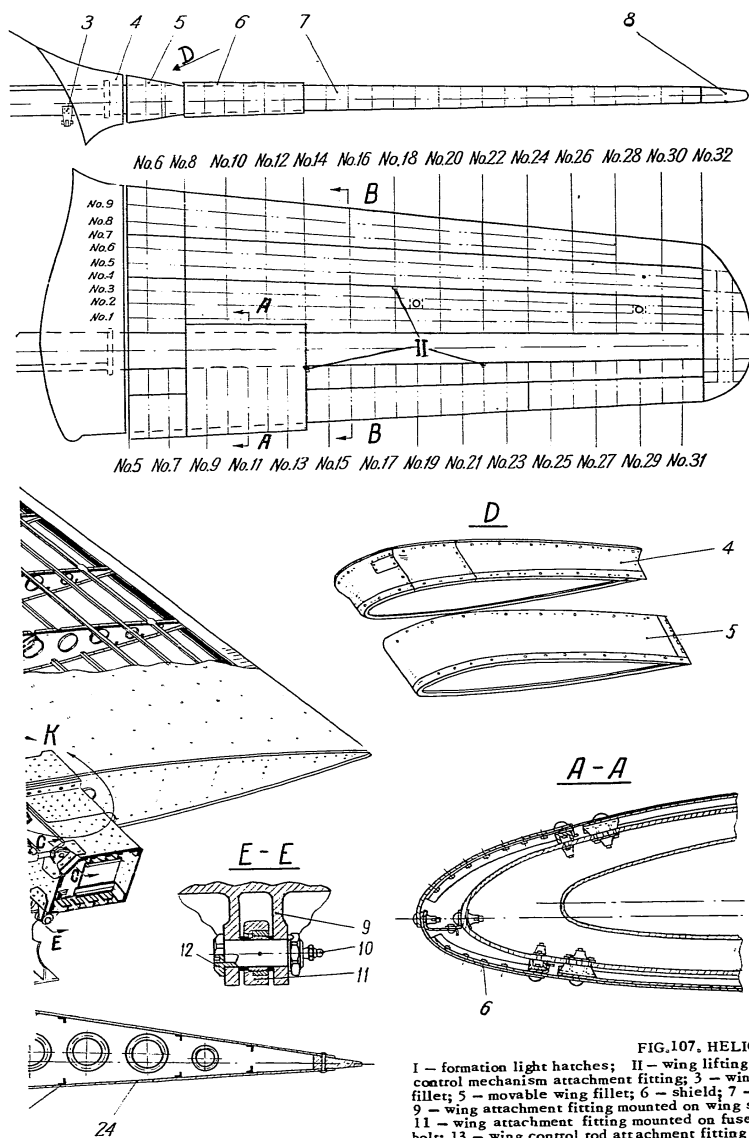


FIG. 107. HELICOPTER WING

I - formation light hatches; II - wing lifting units; 1 - centre-plane beam; 2 - wing control mechanism attachment fitting; 3 - wing attachment fitting; 4 - fixed fuselage filler; 5 - movable wing filler; 6 - shield; 7 - wing cantilever; 8 - tip fairing; 9 - wing attachment fitting mounted on wing spar; 10 and 14 - grease fittings; 11 - wing attachment fitting mounted on fuselage; 12 - wing-to-fuselage attachment bolt; 13 - wing control rod attachment fitting mounted on wing spar; 15 - wing control rod attachment bolt; 16 - wing control rod; 17 - nose rib; 18 - angle bar; 19 - section; 20 - stringer; 21 - section; 22 - tail rib; 23 - stringer; 24 - skin.

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Smooth transition between the wing and the fuselage is ensured by a fillet which covers the centre-plane beam and the cut made in the fuselage. The fillet consists of two separate parts: one part is rigidly fixed to the fuselage, and the other part (secured to the wing) is a movable one, being capable of turning along with the wing.

The fillet is made from sheet duralumin and consists of an outer skin and inner partitions riveted to one another.

The upper skin on the middle portion of the fixed fillet (above the centre-plane beam) is reinforced by corrugated sheet duralumin.

STABILIZER

To ensure the required stability and controllability of the helicopter, the latter is provided with a stabilizer which can be controlled while in flight. The stabilizer angle of attack is changed with the aid of the collective pitch-throttle control lever when the latter is used to change the collective pitch of the main rotor.

The stabilizer profile (see Fig.110) is formed by symmetrical airfoil NACA-0012. The stabilizer consists of two halves (the starboard and port ones) symmetrically arranged with respect to the tail boom and interconnected by a spar.

Each stabilizer half is a riveted structure made up of spar 1, a set of ribs (partitions), leading edge duralumin skin 9, tail stringer 12, tip 10, and fabric covering 11.

The beam-type spar consists of an upper and a lower flanges formed by the MIG-T MK-4 duralumin angle bars and of duralumin stamped web 8.

The spar flanges in both stabilizer halves are reinforced on the stretch from the joint up to rib No.3 with bands 19 made from steel 30XICA-E2.0. The bands are placed on top of the skin and held to the spar flanges by bolts, screws with anchor nuts, and, partially, by rivets.

Bolted on top of bands 19 are cromansil cover plates 16 whose function is to reinforce the spar in the vicinity of the joint.

Riveted to the front portion of the spar middle part skin are 30XICA steel stiffeners 18 braced with additional bolts 17 just where the stabilizer is jointed up.

The webs of face ribs 5 are backed up with duralumin sections 4; cover plates 6 made from MIG-T MI.5 duralumin are riveted to front stringers 7 in the top and bottom portions of the stabilizer.

The ribs and partitions are stamped from duralumin sheets. The tail rib flanges are provided with beads; the holes made in the beads serve for attaching the fabric covering.

The leading edge of the stabilizer is faced with duralumin skin 9 (0.8 mm thick) whereas the trailing edge is provided with fabric covering 11.

Stabilizer attachment fittings 15 are arranged on the spar at face ribs 5. The attachment fitting of stabilizer control rod 2 is located on the spar middle portion, being displaced by 124 mm to the right from the axis of symmetry (if viewed in the direction of the flight).

The stabilizer halves are bolted to each other with the aid of connecting flanges 3 and a duralumin strip riveted to the spar web rear.

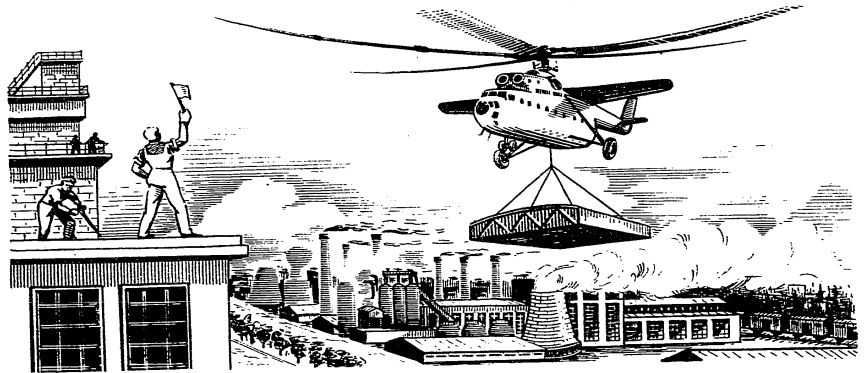
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Chapter III

MAIN ROTOR

GENERAL

The purpose of the main rotor is to develop aerodynamic forces required for helicopter motion through the air and for controlling this motion with regard to helicopter longitudinal and lateral axes.

The main rotor comprises a hub and five blades. Each blade is connected with the hub body by means of three hinges: flapping hinge, drag hinge, and feathering hinge. The connection is accomplished by joining the attachment lug of the blade with that of the feathering hinge. The hub is fitted onto the main gear box shaft.

During translational motion of the helicopter, the varying aerodynamic and inertia forces cause the blades to move with respect to the flapping and drag hinges and to turn in the feathering hinges. These motions are balanced due to flapping compensation being taken into account in the design of the main rotor hub.

The use of hinge attachment of the blades to the hub reduces considerably the varying stresses in the blades and hub, as well as the aerodynamic force moments transmitted to the fuselage.

Basic Specifications

Diameter of main rotor	35 m
Number of blades	5
Direction of rotation	counterclockwise if viewed from below (from main gear box)
Blade shape (if viewed from above or below)	rectangular
Chord	b = 1000 mm

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Blade profile	airfoil NACA-230M for blade sections Nos 1 to 17, airfoil HATY for blade sections Nos 19 and 20, and a transition airfoil from NACA-230M to HATY type for section No.18
Relative profile thickness	sections Nos 1 and 2 - 17.5% sections Nos 4 to 6 - 14.5% sections Nos 8 to 17 - 13% sections Nos 19 and 20 - 11.5% sections 3, 7, and 18 have transition profile thicknesses
Blade twisting angle on stretch from cross-section No.1 to cross-section No.21 (see Fig.111)	5°48' (changes in accordance with linear law)
Blade weight	691 kg

1. MAIN ROTOR BLADE

The main rotor blade is an all-metal type manufactured with the use of cement joints (see Fig.111).

The basic structural component of the blade is a steel tubular spar located on 17% MAC from the airfoil leading edge. Secured to the spar are the attachment lug along with its components, the framework comprising 20 blade sections, and the root and tip fairings. The blade sections serve to develop a lifting power and to transmit the aerodynamic and inertia forces to the spar.

Due to the accepted method of blade section-to-spar attachment, the sections are subjected to but insignificant bending stresses.

The first six sections are 800 mm wide each, whereas the remaining fourteen sections are 600 mm wide each. A blade section consists of a leading and a trailing edges. The gaps provided between the sections make them free to turn with respect to each other when the spar is being bent.

To prevent the flow of air in the gaps between the sections, use is made of rubber inserts 5 arranged in these gaps.

Provided on the top and bottom surfaces of blade section No.6 are access hatches protected by doors 13. Steel bracket 11 inside the hatches with shackles 12 attached to it serves for blade lifting.

The helicopter blade tracking light is arranged under a detachable fairing at the blade tip. The surfaces of the blade sections are painted. The blade is provided with an electrical de-icing system.

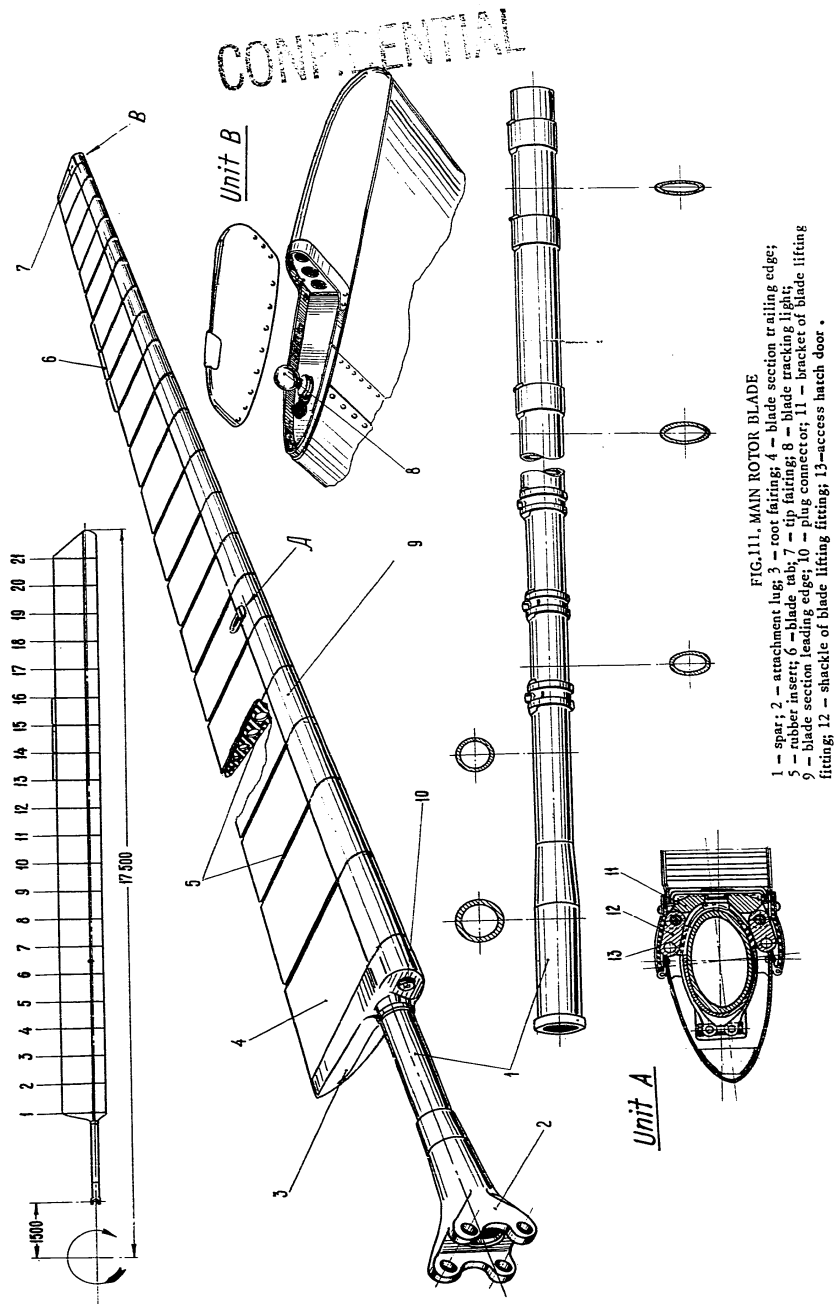
SPAR

The blade spar is made from a cold-rolled seamless steel tube 15,610 mm long. The tube wall thickness and cross-sections vary from root to tip of the blade. The spar tube is heat-treated to $\sigma_B = 120 \pm 10$ kg/sq.mm.

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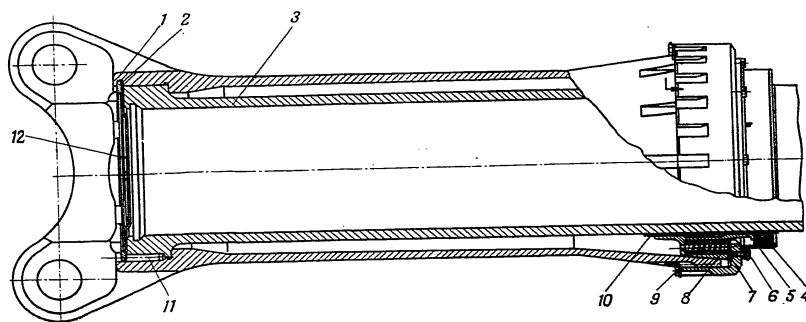


FIG.112. BLADE ROOT ATTACHMENT UNIT

1 - blade attachment lug; 2 - spring ring; 3 - spar; 4 - rubber sealing; 5 - holder; 6 - bolt; 7 - spring; 8 - split cone; 9 - nut; 10 - shim; 11 - pins; 12 - plug.

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To add to the dynamic strength of the tube, its outer and inner surfaces are polished and cold-hardened all over the tube length.

Corrosion of the spar is prevented by application of synthetic resins all along the tube outer surface; the inner surface of the spar tube is prime-coated for the same purpose.

The steel blade attachment lug (Fig. 112) is fitted onto the spar so that the blade centrifugal force is transmitted to the lug through the tube flange, whereas the torque from the blade is taken up both through friction on the tube flange and through the use of eight steel pins that fix the relative angular position of the tube and the attachment lug. Axial displacement of the spar with respect to the attachment lug (towards the hub axis) is restricted by spring ring 2 inserted into the circular groove of the attachment lug.

The bending moments in the spar root are taken up in the attachment lug by two supports: the tube flange and the collar arranged on the tube at the thin end of the attachment lug. The latter support is formed by means of split bronze cone 8. The cone is displaced axially to take up the clearance between spar tube 3, attachment lug 1, and cone 8 by tightening attachment lug nut 9.

The spar tube stretch over which the bronze cone travels is coated with shim 10 made of lavsan. This shim is 0.5 mm thick, its edges being secured to the spar with cement IV-2.

The faces of the shim are sealed up. Shim 10 is used in this place to avoid fretting which may occur at minor displacements of the tube with respect to the attachment lug when the blade is being bent.

The nut is to be tightened with a torque of 250 ± 20 kg-m. Loose fit of the nut while in service is compensated for by springs thrust against the nut face. These springs are equispaced over the bronze cone circumference in special seats.

Rubber sealing 4 serves to prevent moisture from getting under the attachment lug. Plug 12 located in the front portion of the spar protects the inner cavity of the latter against penetration of dirt or water.

LEADING EDGES OF BLADE SECTIONS

The main part of the leading edge is its duralumin skin 1 (Fig. 113), 1.5 mm thick, chemically milled, and provided with a cut for arrangement of the de-icer pack.

The leading edge is made rigid by partitions 2, cemented and riveted to the skin, and by corrugations 4. The first six and the last two blade sections have no corrugations.

Cemented and riveted to the leading edges of blade sections Nos 7 to 20 is counterweight 5 comprising a steel section bar and a weight welded to it.

TRAILING EDGES OF BLADE SECTIONS

The trailing edge outer contour on blade sections Nos 1 to 12 and 16 to 20 is formed by duralumin skin 4 (Fig. 114) 0.4 mm thick and bent to fit the trailing edge of the blade. The trailing edge is made rigid by textolite stringer 5, 1.5 mm thick and cemented inside the trailing edge.

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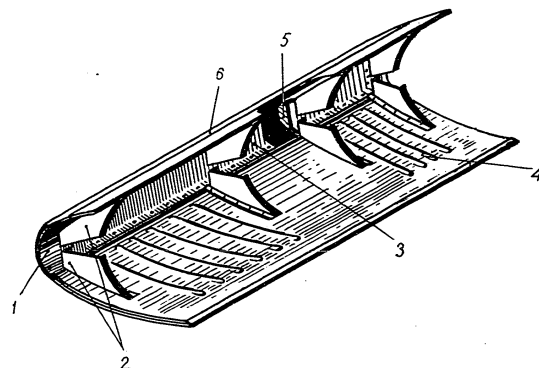


FIG. 113. BLADE SECTION LEADING EDGE
1 - skin; 2 - partition; 3 - section bar; 4 - corrugation;
5 - counterweight; 6 - de-icer pack.

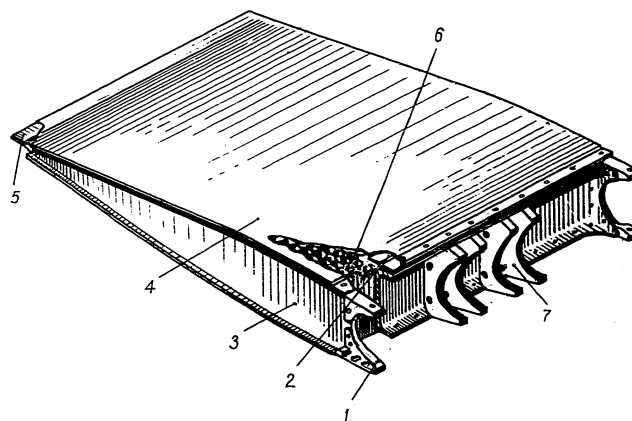


FIG. 114. BLADE SECTION TRAILING EDGE
1 - side plates; 2 - pad; 3 - rib; 4 - skin; 5 - stringer; 6 - honeycomb assembly;
7 - trailing edge shoe.

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Sections Nos 13 to 15 are provided with blade tabs; their top and bottom skins are made from the same material as in the case of other sections. Inserted between the skin sheets on the trailing edge are the stringer and the blade tab, the latter projecting beyond the trailing edge by 75 mm. The top and bottom skins, stringer, and blade tab are cemented and riveted to one another to form a single pack.

Cemented to the top and bottom skin inside surfaces on the trailing edge front portion are pads 2, 1.5 mm thick, which are bevelled towards the section trailing edge. The skin with the pads is cemented to honeycomb assembly 6 which makes the trailing edge rigid. The honeycomb assembly is cemented of aluminum foil sheets 0.04 mm thick that form cells 6 mm in size.

Arranged at the trailing edge sides are ribs 5 whose webs are cemented to the honeycomb assembly, and the flanges, to the skin and pads. Shoe 7 is cemented in the front portion of the trailing edge.

All the trailing edge shoes are made from duralumin and are fitted with protruding strips in the middle. The strips embrace part of the spar from behind and rest against the collars which are cemented to the spar. Drilled in the upper and lower portions of the strips are holes for bolts. Secured on these bolts between the strips are bands which hold the trailing edges of the blade sections to the spar.

A section bar 2 mm thick is glued and riveted to the shoe rear wall and flanges along blade sections Nos 1 to 6. The width of the section bar is equal to that of a blade section. The honeycomb assembly on these sections of the blade is cemented right to the section bar.

The side plates of the blade sections serve for screwing the blade section leading edge to the trailing edge at the blade section sides.

To prevent moisture from getting inside the blade sections, all the cemented joints and production holes on the trailing edges are sealed up.

Cemented and riveted at the root end to the trailing edge of the first blade section is the trailing edge of the root fairing.

BLADE SECTION TRAILING EDGE TO-SPAR ATTACHMENT

Cemented on the trailing edge side to the spar in the middle of sections Nos 1 to 6 (Fig.115) is a steel trunnion braced to the spar by two steel collars. The collars are also cemented to the trunnion and spar. A hole for the trunnion is made in the shoe.

The shoes are fitted onto the trunnion and braced to the spar with four steel bands (two of them being arranged in the upper part, and two, in the lower part); each band is bolted to the shoe.

After the shoes are installed on the spar, their protruding strips are glued to the collars.

The bands embracing the spar are secured to each other in the front portion of the latter with bolts slipped through spiders that are inserted into the bands.

Cemented from the trailing edge side to the spar along sections Nos 7 to 20 (Fig.116) is a retainer. At the blade tip end this retainer is provided with a protruding shoulder serving as a rest for the trailing edge shoe. Arranged between the shoe strip and the shoulder is a collar which braces the retainer to the spar. The retainer and the collar are cemented to the spar and to each other.

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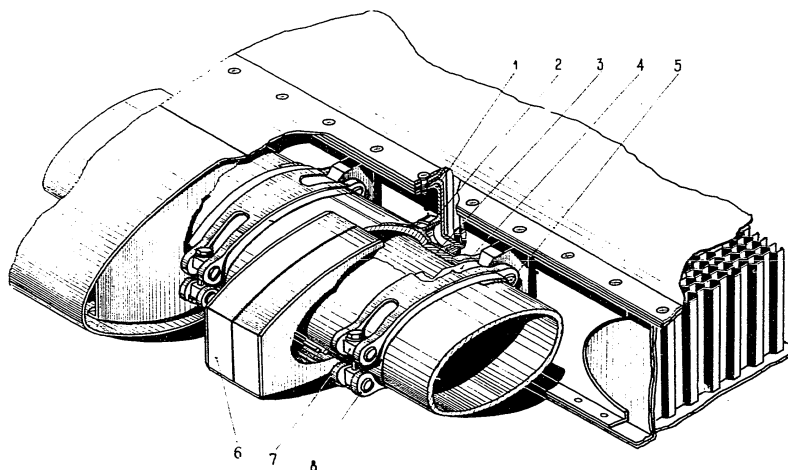


FIG. 115. BLADE SECTION TRAILING EDGE-TO-SPAR ATTACHMENT
(with trunnion)

1 - trailing edge shoe; 2 - trunnion; 3 - spar; 4 - collar; 5 - bolt; 6 - plastic foam block; 7 - spider; 8 - band.

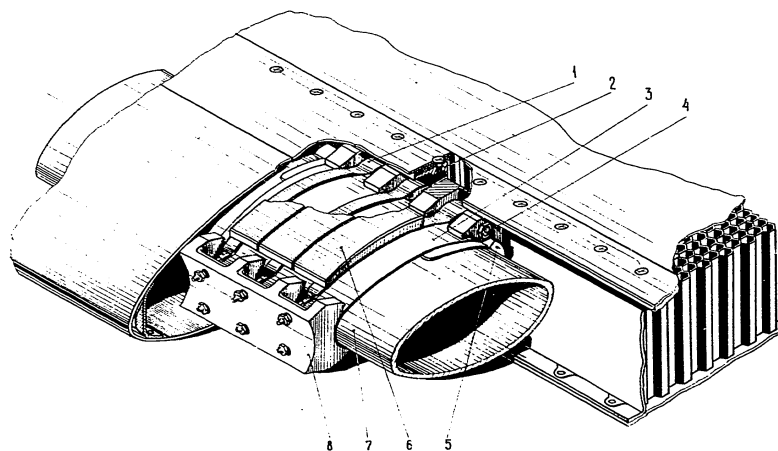


FIG. 116. BLADE SECTION TRAILING EDGE-TO-SPAR ATTACHMENT
(with retainer)

1 - band; 2 - trailing edge shoe; 3 - collar; 4 - bolt; 5 - retainer; 6 - plastic foam block; 7 - spar; 8 - leading edge shoe.

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Just like in the case of sections No. 1 and 4, the trailing edges of blade sections Nos 7 to 20 are braced to the spar by means of bands and short leading edge shoes 6. The front portions of the bands are threaded. In tightening up the bands, a washer is inserted between the nut and shoe. On the side of the nut, the washer has a concave spherical surface mating with the nut convex spherical surface. Such construction of the nut and washer permits centering of the band with regard to the shoe when the band is being tightened up.

Blade section No. 16 carries a special leading edge shoe whose construction provides for the installation of a leading edge weight, if required. Therefore, this leading edge shoe is braced to the spar with two additional bands.

To avoid fretting, lacquer shims are placed between the collars and the bands on all the blade sections. All the cemented joints of the retainer, trunnion, and collar to the spar, as well as those of the shoes to the collars are sealed up.

LEADING EDGE-TO-BLADE ATTACHMENT

The leading edges are installed on the blade trailing edges by means of a stepped connection. The leading and trailing edges of the blade are cemented to each other all over their contacting surfaces and are screwed to the trailing edge shoes. The screws are countersunk and coated with a glue which prevents them against working loose.

The middle part of each blade section is provided with a plastic foam block reinforced with plywood. The block is cemented to the spar and serves as a support for the leading edge which is, in turn, cemented to the block.

At the edges of each blade section, the leading and trailing edges are interconnected with screws slipped through the side plates of the trailing edges.

ROOT FAIRING

Root fairing 3 (Fig. 111) consists of two portions: a leading edge and a trailing edge. The trailing edge of the fairing is cemented and riveted to that of the first blade section and is made rigid with the aid of duralumin partitions. The leading edge of the fairing is connected with the leading and trailing edges of the first blade section by screws. Placed between the spar and the fairing which braces the latter is a rubber gasket.

Secured on the spar under the fairing leading edge is a bracket, on which a plug connector is mounted. Made in the fairing leading edge on the root side is a port through which the electric bunched conductor is passed to the plug connector.

TIP FAIRING

The tip fairing, just like the root one, consists of a leading edge portion and a trailing edge portion (see Fig. 117). The leading edge is manufactured from stainless steel, whereas the trailing edge is made from duralumin.

The fairing trailing edge has a framework assembled of partitions cemented and riveted to the skin. Connected just in the same way to the skin along the

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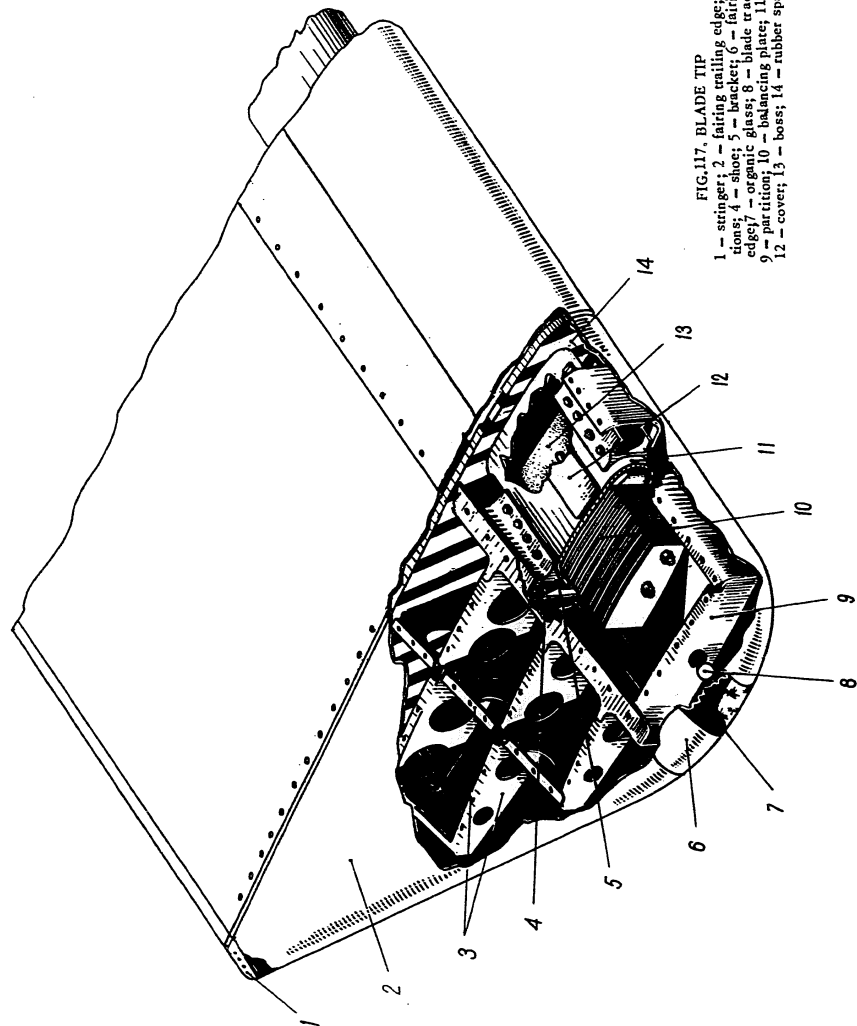


FIG. 117, BLADE TIP
 1 - stringer; 2 - fairing trailing edge; 3 - partition; 4 - fairing leading edge; 5 - fairing leading edge; 6 - fairing leading edge; 7 - fairing leading edge; 8 - fairing leading edge; 9 - fairing leading edge; 10 - fairing leading edge; 11 - fairing leading edge; 12 - fairing leading edge; 13 - fairing leading edge; 14 - fairing leading edge.

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fairing trailing edge is a textolite stringer. Riveted to the fairing on the root side is a shoe which is secured to the spar with bolts. A step is cut in the front portion of the fairing trailing edge to receive the leading edge of the fairing.

On the root side, the fairing leading edge is provided with a stiffening partition, and on the opposite side, with a port protected by organic glass; the port serves to accommodate the blade tracking light.

During installation, the fairing leading edge is fitted onto a section bar connected at its root end with a special shoe riveted to the spar.

At the end of the blade the section bar is connected with a partition to which the blade tracking light is secured. This partition is attached to the front wall of the fairing trailing edge.

The fairing leading edge is screwed to the trailing edge portion, partitions, and front section bar.

BALANCE WEIGHT

Inserted into the spar end is a steel boss connected to the spar by two pins that are protected from the spar top and bottom with covers preventing them from falling out. The covers proper are secured to the spar with screws. Threaded into the boss are two studs holding 5 mm-thick steel balancing plates.

The plates serve for mutually balancing separate blades within one set for proper static moments with regard to the axis of rotation.

BLADE DE-ICING SYSTEM

The blade de-icing system (Fig. 118) serves to protect the blades against ice formation while in flight. This is achieved by periodical removal of the accumulated ice from the blades by means of switching on the de-icing system power supply at regular intervals.

The connection of the leading edge heaters is in parallel; the voltage applied is 208 V.

The leading edge of each blade section is provided with one heater; so there are twenty heaters altogether per every blade. The leading edges of the fairings are not heated.

The heaters of each blade are grouped electrically into two sections comprising ten heaters each. The size of the heated blade surface (as measured along the chord) varies with the off-hub distance. It is 11.5 per cent for the root sections of the blade, and 14.5 per cent, for the tip ones.

The leading edge heater pack of each blade section comprises the bottom insulation (made up of four layers of glass fabric), heating element proper, and two layers of insulation arranged on top. All the insulation layers are saturated with cement. The heating element is made from stainless steel and is shaped as a snake formed by a large number of narrow strips from 8 to 11 mm wide. The thickness of the element is from 0.06 to 0.1 mm.

The entire de-icing system pack on the stretch from the first to the eighth blade section is protected on top with a 0.5 mm-thick duralumin tipping cemented to the pack. The tipping has a hard-anodized surface.

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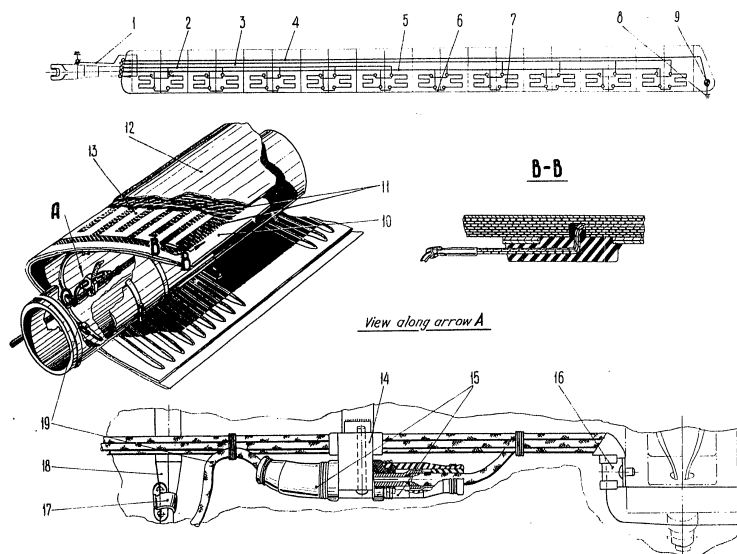


FIG. 118. BLADE DE-ICING SYSTEM

1 - blade-to-structure bonding strip; 2 - first heating section power supply wire; 3 - second heating section power supply wire; 4 - blade tracking light power supply wire; 5 - first and second heating section zero phase; 6 - bonding strip between blade sections; 7 - electrical heating element; 8 - bonding strip to structure; 9 - blade tracking light; 10 - skin; 11 - insulation; 12 - blade tipping; 13 - heating element; 14 - terminal block; 15 - termination of wire in terminal block; 16 - attachment of bunched conductor to shoe; 17 - rubber clip; 18 - U-clamp; 19 - power supply wire.

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The remaining blade sections are cemented with 0.5 mm-thick rubber to prevent wear of their leading edges. Cemented on top of the rubber on a stretch of 50 mm as measured along the chord from the leading edge, is a tipping made from stainless steel 0.5 mm thick.

Each heating element has two busbar leads, the ends of which are coiled up to form tubes; soldered into these tubes are the wire leads. The solder splices are protected with special rubber clips cemented to the leading edge skin.

The rubber clips are additionally secured to the leading edge skin with the aid of U-clamps.

Power is applied to the heaters and to the blade tracking light through a plug connector arranged in the blade root. Terminated on this plug connector are the wires of the bunched conductor running along the spar.

The power supply wires are connected to the heaters through terminal blocks secured to the spar inside the blade sections. Soldered into the same terminal blocks are the lead-out wires of the heaters. To avoid damage to the wires due to blade oscillations, the heater lead-out wires are secured to the bunched conductors.

To reduce radio interference and to remove static electricity from the blade surface, the latter is bonded. The bonding wire runs from the plug connector which is bonded through the slip ring assembly bunched conductor to the helicopter structure, to the blade spar and is secured to the latter at the end of the blade. The blade sections are bonded to one another, and to the spar and plug connector just as well.

2. MAIN ROTOR HUB

Basic Specifications

Hub design	with turned flapping hinges and drag hinges, flapping compensation being allowed for
Flapping hinge radius a (Fig.121)	400 mm
Drag hinge radius b	840 mm
Displacement of flapping hinge lug middle (a)	65 mm
Flapping hinge turning angle ξ	$5^{\circ}46'$
Flapping compensation factor K	0.4
Type of damper	hydraulic
Flapping angle (as measured upward from plane normal to axis of rotation)	$25^{\circ} \pm 30'$
Drooping angle (as measured downward from plane normal to axis of rotation):	
(a) when resting on gimbal attachment	$7^{\circ} - 15'$
(b) when resting on centrifugal blade droop limiter pawl	$2^{\circ}10' \pm 5'$
Turning angles with respect to drag hinge (from position normal to flapping hinge axis):	

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- (a) forward, in direction of hub
rotation $14^{\circ} \pm 15'$
- (b) rearward, in opposite direc-
tion $18^{\circ} \pm 10'$
- Weight of hub when dry 3250 kg
- Overall dimensions of hub:
- diameter 3115 mm
- height 460 mm
- Adjustment of centrifugal blade droop
limiters:
- (a) mechanisms operate when main rotor
is accelerated to 80^{+4}_{-2} r.p.m.
- (b) mechanisms operate when brakes are
applied to main rotor at 70^{+3}_{-1} r.p.m.
- Lubricant used

Description of unit	Oils used	Amount of oil to be used, kg	
		per unit	per hub
Flapping hinges	Hypoid oil, State Stand- ard IOCT 4003-53	4.8	24.0
Drag hinges	Same	0.9	4.5
Feathering hinges	MC-20 oil, State Stand- ard IOCT IOI3-49 (in summer)		
	MC-14 oil, State Stand- ard IOCT IOI3-49 (in winter)	8.4	42.0
Hydraulic dampers	AMP-10, State Standard IOCT 6794-53	4.0	20.0
Remaining hinges	IMATVM-20I, State Stand- ard IOCT 6267-59		

The function of the hub is to transmit rotation from the main gear box to the blades, as well as to take up the aerodynamic forces originating on the main rotor and send them over onto the fuselage.

The blades are secured to the hub body with the aid of the flapping, drag, and feathering hinges (Fig.119).

The flapping hinges permit the blades to flap in the vertical plane under the action of aerodynamic forces which vary in azimuth. Such forces are developed during translational motion of the helicopter.

The drag hinges permit the blades to oscillate in the plane of rotation. These oscillations are due to the action of varying drag and Coriolis inertia forces developed during oscillations of the blade with respect to the flapping hinge. The hinged connection of the blades with the hub body results in a considerable decrease of the varying stresses in the main rotor components and, hence, in a decrease of the aerodynamic forces transmitted from the hub body to the fuselage.

The purpose of the hub feathering hinges is to change the blade setting angles.

Blade oscillations with respect to the drag hinge are suppressed by the hydraulic dampers. The hub is so designed that, with a blade flap relative to the flapping

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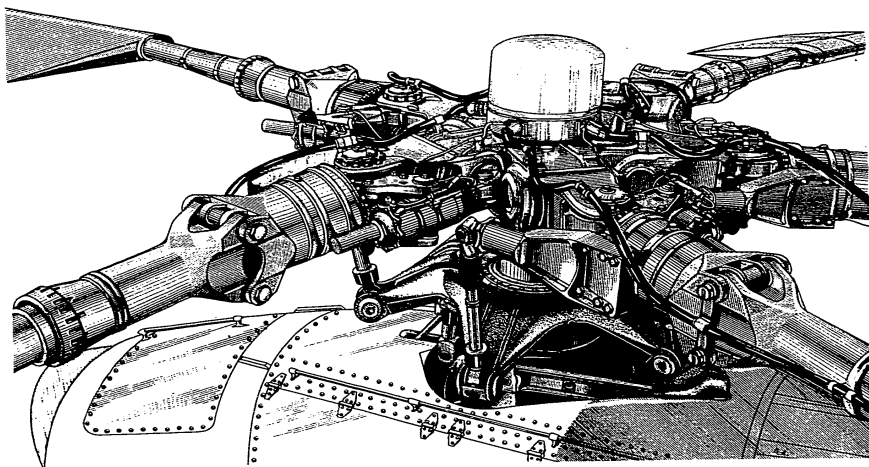


FIG. 119 MAIN ROTOR HUB.

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hinge through an angle of β , the true blade setting angle decreases by a value of $\Delta\varphi = -K\beta$.

The proportionality factor (K) is normally referred to as flapping compensation. The value of the flapping compensation factor for the hub of type Mk-6 helicopter is equal to 0.4.

The presence of flapping compensation increases the stability of blade motion with regard to the hub hinges and improves the performance characteristics of the main rotor and the helicopter as a whole.

To reduce the blade droop and provide for the required clearances between the blades and the tail boom with the main rotor stopped or running at low speed, the hub features centrifugal blade droop limiters.

The main rotor hub (Fig.120) comprises the following main parts: hub body 4, gimbal attachments 7, feathering hinge trunnions 67, feathering hinge bodies 26, and blade turning arms 44.

Hub body 4 is connected with the main gear box shaft through involute splines and centred with the aid of two cones: bronze split lower cone 57 and steel upper cone 2 composed of two halves.

The hub body is secured to the shaft with the help of nut 1 locked with pins 5. The nut is tightened by a special hydraulic wrench. The body has five wide lugs (one lug per each blade) located in one plane at an angle of 72° with respect to one another. Together with gimbal attachment 7 they form the flapping hinges.

Needle bearings M and H of the flapping hinge (Fig.121) are located symmetrically to perpendicular O_1O_2 projected from centre O_2 of the drag hinge onto the flapping hinge axis.

The middles of the hub body lugs are displaced from the axis of rotation by a distance of $a = 85$ mm. With the lugs so positioned, the flapping hinge proves to be turned with respect to the radial direction through angle ξ .

Angle ξ equals $5^\circ 46'$ and is so selected that at the main flight attitudes blade aerodynamic and centrifugal force resultant R is directed approximately along line O_1O_2 . This ensures a more uniform distribution of the load between the flapping hinge needle bearings, thus considerably increasing their service life, and results in a reduction of the axial force taken up by the flapping hinge thrust bearings.

Located inside each of the hub body lugs is cavity P filled with oil for lubricating the flapping hinge bearings (see Fig.120).

The use of needle bearing outer races 64 in the hub body ensures oil supply to the most loaded needles (due to action of the centrifugal forces) even when cavity P is filled but partially with oil.

The oil is filled into the cavity of the lugs through filters 3 and drained through holes stopped with drain plugs 85. Each lug is provided with upper and lower rests which limit the flapping motion of the blades. Lower rests 84 are made changeable which permits their replacement while in service in case of cold hardening or other defects.

There is a slot in the lower portion of the hub body which serves for fixing the bracket of the swashplate ring carrier shackle.

The double-row needle bearings of the flapping hinge comprise the outer and inner races and a set of needles 55, 6 x 60 mm in size (220 needles in each bearing). Outer races 64 are secured in the hub by nuts 61 which are locked by plates 6 screwed to the hub body.

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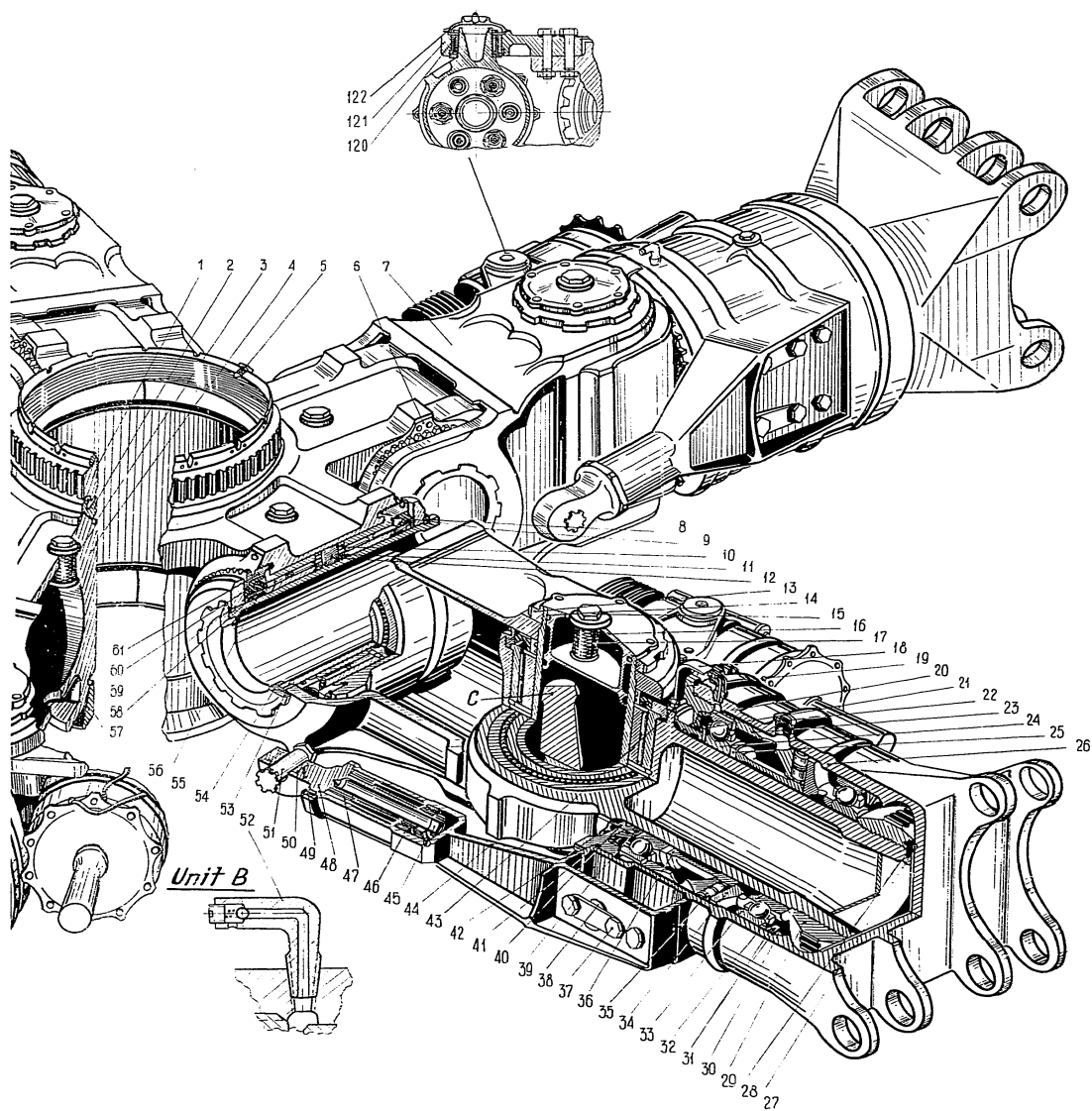
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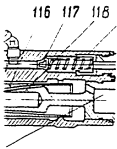


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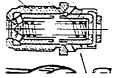
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Unit A

106 107 108



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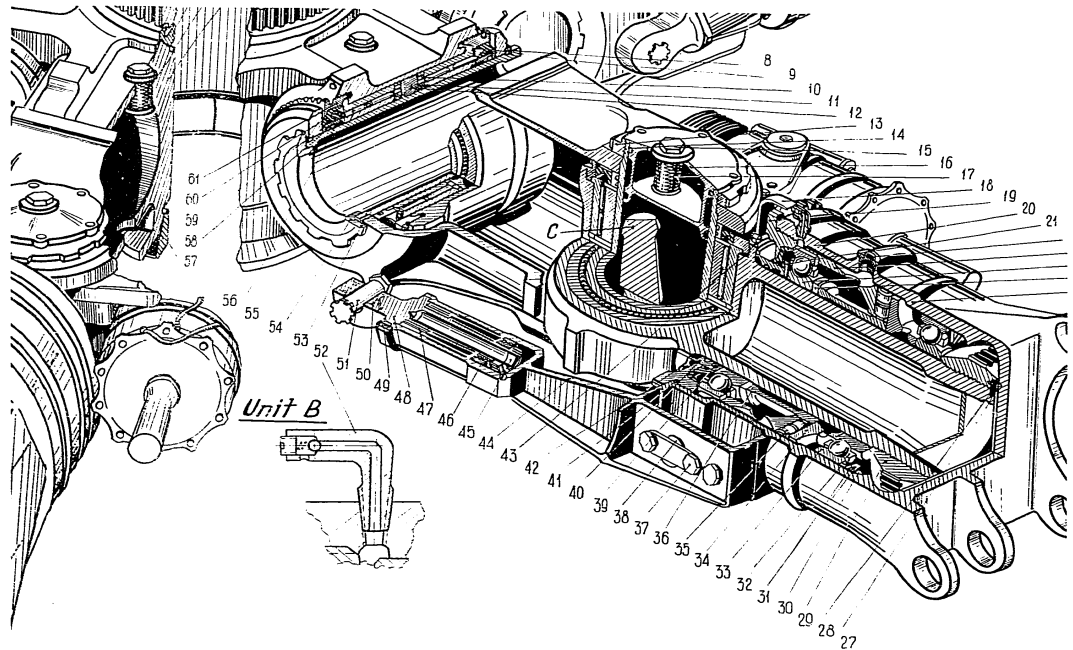


FIG. 120. CONSTRUCTION OF MAIN ROTOR HUB

1-shaft nut; 2-upper cone; 3-filter; 4-hub body; 5-locking pin; 6-locking plate; 7-gimbal attachment; 8-ring; 9-sealing ring; 10-thrust roller bearing; 11-limiting ring; 12-thrust ring; 13-nut; 14-sealing ring; 15-plug; 16-sleeve; 17-filter; 18-vernier; 19-feathering hinge body nut; 20-collar; 21-oil deflecting ring; 22-plug; 23-bearing thrust bush; 24-radial ball bearing; 25-adjusting ring; 26-feathering hinge body; 27-bolt; 28-locking plate; 29-trunnion nut; 30-adjusting ring; 31-bellville springs; 32-washer; 33-radial ball bearing; 34-bearing thrust ring; 35-roller bearing (cage); 36-bushing; 37-bolt; 38-pin; 39-sealing ring; 40-thrust ring; 41-sealing ring; 42-collar; 43-locking; 44-blade turning arm; 45-plug; 46-two-row ball bearing; 47-needle bearing; 48-blade arm shaft; 49-bolt; 50-needle bearing; 51-blade rod pin; 52-safety valve; 53-key; 54-nut of flapping hinge pin; 55-needle; 56-sealing ring; 57-lower cone; 58-distance sleeve; 59-locking ring; 60-collar; 61-flapping hinge nut; 62-flapping hinge pin; 63-bearing inner race; 64-bearing outer race; 65-thrust roller bearing; 66-limiting ring; 67-feathering hinge trunnion; 68-drag hinge nut; 69-bearing outer race; 70-collar; 71-distance sleeve; 72-sealing ring; 73-bearing inner race; 74-thrust ring; 75-arm; 76-weight; 77-springs; 78-arm support; 79-drag hinge pin; 80-rod; 81-sealing ring; 82-pawl axle; 83-pawl; 84-rest; 85-plug; 86-sleeve; 87-damper cover; 88-sealing ring; 89-valve; 90-piston; 91-piston ring; 92-rod; 93-leather ring; 94-sealing ring; 95-damper cylinder; 96-shock absorber; 97-boot; 98-damper rod fork; 99-bush; 100-pin; 101-sealing ring; 102-needle bearings; 103-pin; 104-shackle; 105-cone; 106-valve body; 107-spring; 108-nut; 109-pipe; 110-pipe; 111-valve box; 112-elbow; 113-pipe; 114-plug; 115-spring; 116-tapered adjusting needle; 117-valve; 118-tapered adjusting needle; 119-body; 120-needle bearing; 121-damper bracket; 122-cover; 123-bushing rest; 124-gimbal attachment rest; 125-pawl; 126-rod; 127-arm; 128-equalizing springs; 129-counterweight.

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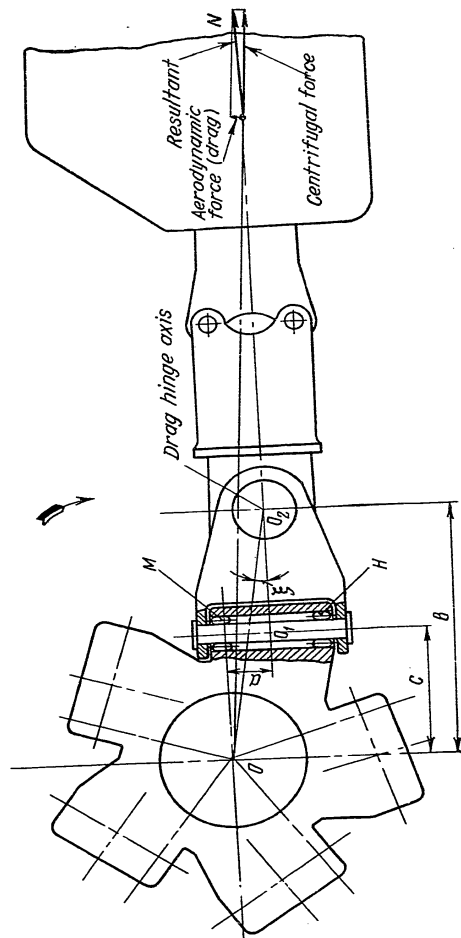


FIG. 121. ARRANGEMENT OF HUD HINGES.

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Inner bearing races 63, limiting rings 11 (which fix the needles in the axial direction), distance sleeves 58, and thrust rings 12 are all mounted on flapping hinge pin 62 and tightened in between the gimbal attachment lugs with the aid of nut 54 locked with washer 59. The pin split ring 8 rests against the gimbal attachment; the pin is kept against rotation by key 53. The inner cavity of pin 62 is protected against the penetration of moisture by a rubber partition arranged on the side of ring 8; on the opposite side it is sealed by a plug rolled into nut 54.

Placed between the needle bearing outer races and thrust rings 12 are two thrust roller bearings 10 which serve to take up the axial stresses developed with the blade deflecting from the direction normal to the flapping hinge axis.

The flapping hinge is sealed with fixed rubber rings 9 and 56 and reinforced collars 60. The collar is provided with an additional sealing band which protects the main working edge against dust and premature wear.

Gimbal attachment 7 is a box-shaped part. Its ends are provided with lugs intended for connecting the attachment with hub body 4 and feathering hinge trunnion 67; the lug axes are at right angles to each other. The connection of the gimbal attachment with the trunnion forms the drag hinge whose design is similar to that of the flapping hinge.

Mounted in the cylindrical cavity of the trunnion head are two double-row needle bearings comprising outer and inner races and a set of needles, 5 x 44 mm in size (228 needles per each bearing).

Outer races 69 of the bearings are secured to the trunnion with nuts 68 locked with plates 43 that are screwed to the trunnion. Inner bearing races 73, limiting rings 66 (which fix the needles in the axial direction), distance sleeves 71, and thrust ring 74 are all slipped onto drag hinge pin 79 and tightened in between the gimbal attachment lugs with the aid of nut 13. To take up the axial stresses, use is made in the drag hinge of thrust roller bearings 65 located between the races of outer races 69 and thrust ring 74.

The drag hinge is sealed by reinforced collar 70 and rubber rings 72 and 81, which are similar in design with the like parts of the flapping hinge.

Secured in the upper part of pin 79 is sleeve 16 with filter 17. Plug 15 is used to blank off the hole through which oil is filled into the sleeve. The oil flows to the needle bearings through drillings made in the sleeve and the pin. Sealing rings 14 prevent the oil from leaving sleeve 16.

To facilitate air release from the drag hinge, a grease fitting is screwed into the bottom of the trunnion head. On being forced in through the grease fitting during assembly, oil flows through the holes made in lower outer race 69 to the needle bearings and causes the air to leave the drag hinge through the safety valve located in the upper portion of sleeve 16 in the vicinity of filter 17. Oil is then added right into sleeve 16.

Secured in the lower part of the drag hinge pin is support 78 of arm 75 along with weight 76 of the centrifugal blade droop limiter mechanism. The weight is secured to the arm and connected with pawl 83 through rod 80. Pawl 83 is free to rotate about pawl axle 82 passed through the gimbal attachment lugs.

Springs 77 retain weight 76 and press pawl 83 to the gimbal attachment when the main rotor speed is within the range from 0 to 80⁺⁴₋₂ r.p.m.

The operation of the centrifugal blade droop limiter is diagrammatically shown in Fig. 120. With the main rotor running, centrifugal force C of weight 129 tends to move pawl 125 away from gimbal attachment rest 124.

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At low RPM of the main rotor the moment of the weight centrifugal force with respect to axis of rotation A of arm 127 is less than the moment of spring tension force N; as a result, pawl 125 is pressed to gimbal attachment rest 124. In this case, the blade droop angle is equal to $2^{\circ}10' \pm 5'$. As the main rotor RPM are increased, the moment created by the centrifugal force of the weight increases, too. At certain RPM this moment exceeds the tension moment of the spring, and arm 127, overcoming the counteraction of the spring, moves in the direction indicated by arrow B.

As arm 127 is displaced, arm 1 is shortening quicker than the tension of the spring is increasing, due to which the moment of force N is decreasing. At the same time, the moment of the weight centrifugal force somewhat increases as the arm moves in the direction of arrow B. This causes the mechanism to sharply operate; as a result, pawl 125 is quickly withdrawn from the gimbal attachment. In this case, the blade droop is restricted only by gimbal attachment permanent rests 124, which permit the blade to go down through an angle of $7^{\circ}15'$. The mechanisms are adjusted to operate at main rotor RPM equal to 80_{-2}^{+4} .

As the main rotor speed drops down to 70_{-1}^{+3} r.p.m., the mechanism begins to move in the opposite direction, and the pawl sharply returns to the initial position.

The feathering hinge comprises two main parts: trunnion 67 and body 26 (Fig.120). The trunnion head is provided with two flanges for the attachment of hydraulic damper brackets 121 and the rests (which function to limit turning of the blade about the drag hinge axis), and an inner cylindrical cavity accommodating the drag hinge needle bearings. The trunnion has a threaded shank that mounts the feathering hinge bearings: thrust roller bearing which takes up the centrifugal force and two radial ball bearings taking up the bending moments transmitted from the blades.

Arranged in the seats of the thrust roller bearing cage are fifty-six barrel-shaped rollers 21 x 21 mm in size.

The cage seats are located at an angle of $1^{\circ}30'$ to the radial direction. Due to this, the bearing cage, apart from oscillating together with the movable race, moves constantly though very slowly in one direction.

The time required for the cage to turn through 360° , with oscillation amplitude $\phi = 4.5^{\circ}$ and frequency $n = 120$ oscillations per minute, is 50 to 80 min. Continuous displacement of the cage during the oscillations results in a sharp decrease of the number of repeated stresses to which separate elements of the bearing races are subjected; due to this, the bearing service life increases.

The design of the cage employed in the feathering hinge bearings of the **MH-6** helicopter main rotor hub is the best for this type of helicopters, since it ensures an optimal velocity of cage displacement and stable operation of the bearing as a whole. This, in turn, considerably increases the bearing service life and reduces friction losses.

During assembly, the following parts are slipped onto the trunnion shank in the sequence given below: nut 19 along with collars, oil deflecting ring 21, radial ball bearing 24, adjusting ring 25, bushing 36, thrust bushing 23, cage 35 with rollers, thrust ring 34, and radial ball bearing 33; all these parts are tightened up by nut 29. The nut is locked with plate 28, whose lug enters the slot on the trunnion face. The plate is, in turn, secured to the nut with two bolts 27.

Installed in feathering hinge body 26 are adjusting ring 30, two Belleville springs 31, and washer 32. This done, the trunnion shank along with the bearings secured to it is inserted into the feathering hinge body. The entire unit is tightened up with nut 19 locked by a plate which is screwed to the feathering hinge body.

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Thrust bearing 35 is preloaded together with radial bearing 24 by selecting required adjusting ring 25. The purpose of Belleville springs 31 is to create an additional axial load on radial bearing 33. The feathering hinge body is provided with holes through which it is filled with oil and through which oil can be drained from the body; these holes are closed by plugs 22. Besides, there is safety valve 52.

The feathering hinge sealing comprises fixed rubber rings 39 and 41 and collars 20 and 42. Collar 42 protects the main collar against penetration of dust and dirt, thus preventing excessive wear of the main collar working edge. The working edges of the collars operate on the surface of thrust ring 40 pressed onto the trunnion shank. Ring 40 is prevented from turning by two plates 43 screwed to the trunnion top and bottom. Secured to the upper plate is vernier 18. The blade setting angles are graduated through every 1° on the cylindrical collar of feathering hinge body 26. The scale provides for determining the actual blade setting angles after main rotor blade tracking has been adjusted.

The feathering hinge body is made in the form of a sleeve, the bottom of which is provided with lugs for the attachment of the blade. The other end of the sleeve is threaded to receive nut 19 and is fitted with a flange secured to which with the aid of six bolts 37 is blade turning arm 44. Bolts 37 are relieved of shearing stresses by two pins 38.

The end of the blade arm is provided with a cylindrical cavity accommodating shaft 48 carried in two-row ball bearing 46 and needle bearing 47. Cover 49 held to the arm face by eight bolts prevents axial displacement of the shaft. Screwed into the arm is a grease fitting for lubricating the bearings. The inner space of shaft 48 is protected against penetration of oil by plug 45.

Inserted in the eyes of shaft 48 is pin 51 which rotates in two needle bearings 50. This pin connects the blade turning arm with the link of the swashplate. Pin bearings 50 are lubricated through the grease fitting arranged on the shaft head.

Oscillations of the blades relative to the drag hinges are damped with the aid of hydraulic dampers. The hydraulic dampers, as distinguished from the friction ones, are more stable in operation and have a smaller weight.

Hydraulic damper cylinder 95 is provided with two trunnions carried in needle bearings 120 which are installed in brackets 121 connected by means of eight dowel bolts to the flanges of trunnion 67. Screwed into the brackets are covers 122 with grease fittings.

On one side the hydraulic damper cylinder is closed by cover 87 secured to the cylinder by ten bolts. Pressed into the cylinder bottom and cover are bronze bushings in which rod 92 reciprocates. Piston 90 with six by-pass valves 89 (three on each side of the piston) is screwed onto the middle threaded portion of the rod. The piston is fitted with three oil sealing rings 91.

By-pass valve 89 consists of valve body 106, cone 105, and spring 107. The spring rests against nut 108 and presses cone 105 to the seat of valve body 106. The valves are adjusted for opening pressure $p = 28 \pm 0.5 \text{ kg/sq.cm}$.

Fork 98 is screwed onto the threaded end of the rod. Secured to the fork with the help of six bolts is shock absorber 96 comprising two steel plates and a piece of rubber cured to them. The purpose of the shock absorber is to dampen the strikes against the drag hinge rear limiter when the main rotor is being started.

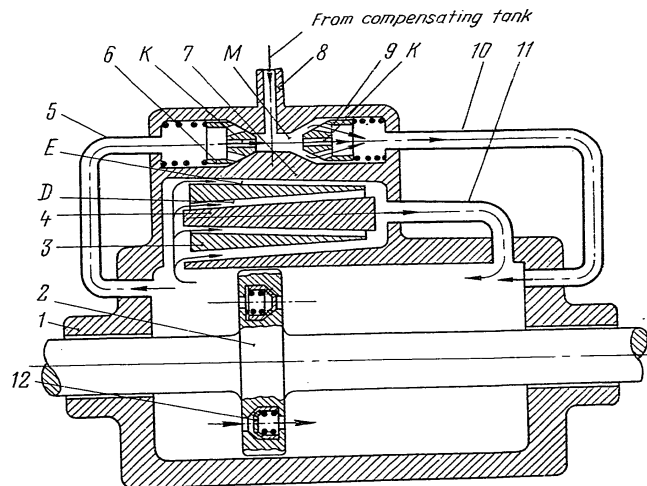
Fork 98 is connected to the flapping hinge pin through shackle 104. The shackle hinges have mutually perpendicular axes, which compensates for probable misalignment

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Hydraulic damper performance
curve
(at constant oscillation frequency)
 P, kg $n = 120 \text{ oscill/min.}$

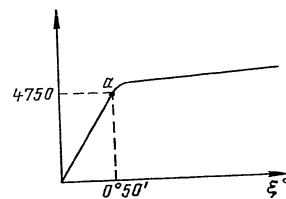


FIG. 122. SCHEMATIC DIAGRAM OF HYDRAULIC DAMPER
1-hydraulic damper cylinder; 2-piston; 3 and 4-tapered needles; 5, 10, and 11-pipelines; 6 and 9-valves; 7-valve box; 8-pipeline to compensating tank; 12-by-pass valve; D-circular clearance between tapered needles; E-circular clearance between tapered needle and valve box body; K-calibrated holes in valves; M-cavity between valves; P-effort on rod; ξ-blade deflection angle relative to drag hinge.

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during installation of the hydraulic damper. Used as a bearing of the hinge that connects the shackle with the fork is bronze bushing 99 mounted on pin 100. The hinge which connects the shackle to the flapping hinge pin is fitted with needle bearings 102 installed on pin 103. The shackle hinges are sealed with round rubber rings 101.

Arranged on fork 98 and cylinder 95 is boot 97 protecting the hydraulic damper rod against contamination. The rod is sealed with rubber rings 94 located in grooves of cylinder 95 and cover 87 between leather rings 93. Cover 87 is sealed with rubber ring 88. Secured to the cover is sleeve 86 which closes the open end of the rod.

Held by six bolts to cylinder 95 is valve box 111 comprising body 119, tapered needles 118 and 116, and valves 117 pressed to the body seats by springs 115.

The lower part of valve box body 119 has an oval hole L through which the valve box communicates with the left-hand cavity of the cylinder. Valve box cavity H communicates with the right-hand cavity of the cylinder through pipe 109.

The borings of the valve box body accommodating valves 117 are connected with the cavities of the hydraulic damper through pipes 113 and 110.

A flexible hose connected to elbow 112 provides for communication of cavity M formed between valves 117 with the compensating tank secured on the main rotor shaft.

Tapered needles 118 and 116 are so arranged in the tapered boring of the body that circular clearances are formed between the needles, as well as between needle 116 and the body; the values of these clearances may be adjusted by screwing adjusting needle 116 in or out. Needle 116 is blanked off by plug 114 sealed after adjustment of the hydraulic damper on the check stand is completed.

Presented in Fig.122 is the hydraulic damper performance curve showing rod effort P as a function of amplitude ξ of oscillations relative to the drag hinge (at constant oscillation frequency $\eta = 120$ oscillations per minute).

At small values of angles ξ (from 0° to $0^\circ50'$), when almost the entire fluid flow passes through clearance D between needles 3 and 4 and clearance E formed between needle 3 and the valve box body, effort P is in direct proportion to the oscillation amplitude. At amplitude $\xi = 0^\circ50'$, the fluid pressure in the hydraulic damper rises to 28 kg/sq.cm; this pressure causes by-pass valves 12 to open (point g in Fig.122).

A further increase in the oscillation amplitude involves a comparatively small change in the rod effort, since in this case the major portion of the fluid is by-passed through the by-pass valves.

A small portion of fluid is directed from one cavity of the hydraulic damper into the other through compensating valves 6 and 9. The valves are provided with calibrated holes K which connect the cylinder cavities with valve box cavity M. The diameter of these holes and the hydraulic resistance of the pipelines are so selected that at all modes of hydraulic damper operation pressure in cavity M does not exceed the pressure built up by the centrifugal forces of the fluid column trapped in the pipeline between the compensating tank and the valve box.

But to this, the fluid cannot flow from the hydraulic damper back into the compensating tank; as a result, operation of the compensating system is reliable and stable. This system provides for continuous compensation of the possible fluid leakage from the hydraulic damper.

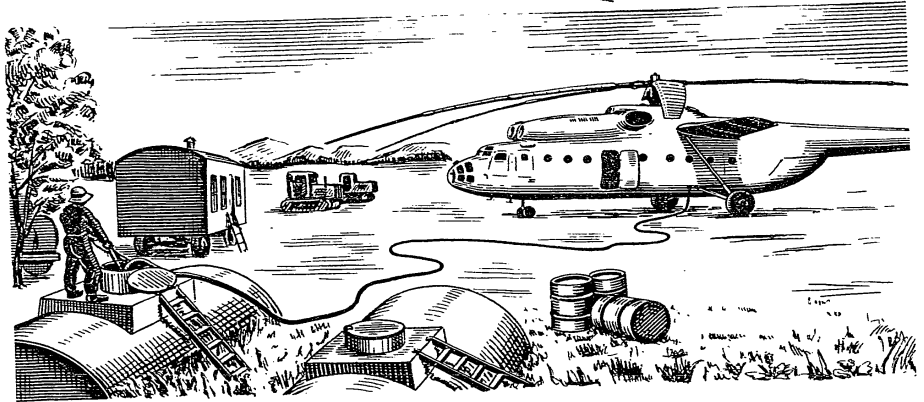
The hydraulic damper is drained through the compensating tank.

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Chapter IV

POWER PLANT

ENGINES

The helicopter is powered by two turbo-rotor engines A-25B employing two-stage free turbines whose torque is transmitted to the shaft of the main gear box.

The engines are arranged above the cargo compartment symmetrically to the longitudinal axis of the helicopter; they are inclined downward to an angle of 5° relative to the fuselage axis and are enclosed in a common cowl.

The engines operate on kerosene TC-1 (State Standard IOCT 10227-62), T2 (State Standard IOCT 10227-62), or T1 (State Standard IOCT 10227-62), which is contained in eleven main and two external fuel tanks.

Each engine is provided with two independent lubricating oil systems. One system, using transformer oil or oil MK-8, is designed for lubrication of the engine turbo-compressor section. The other system, employing a mixture of transformer oil or oil MK-8 and oil MK-22 or MC-20, serves for lubrication of the free turbine (tail rotor turbine), the engine transmission, and the main gear box.

ENGINE ATTACHMENT

The engines (Fig.123) are attached in two zones: the front zone taking up the torque and stresses arising in the crosswise plane and the rear zone taking up (in addition to the above stresses and torque) the stresses acting in the longitudinal direction.

The front attachment unit of the engine consists of three adjustable struts with rubber shock absorbers, similar in construction and differing in length only (Fig.124).

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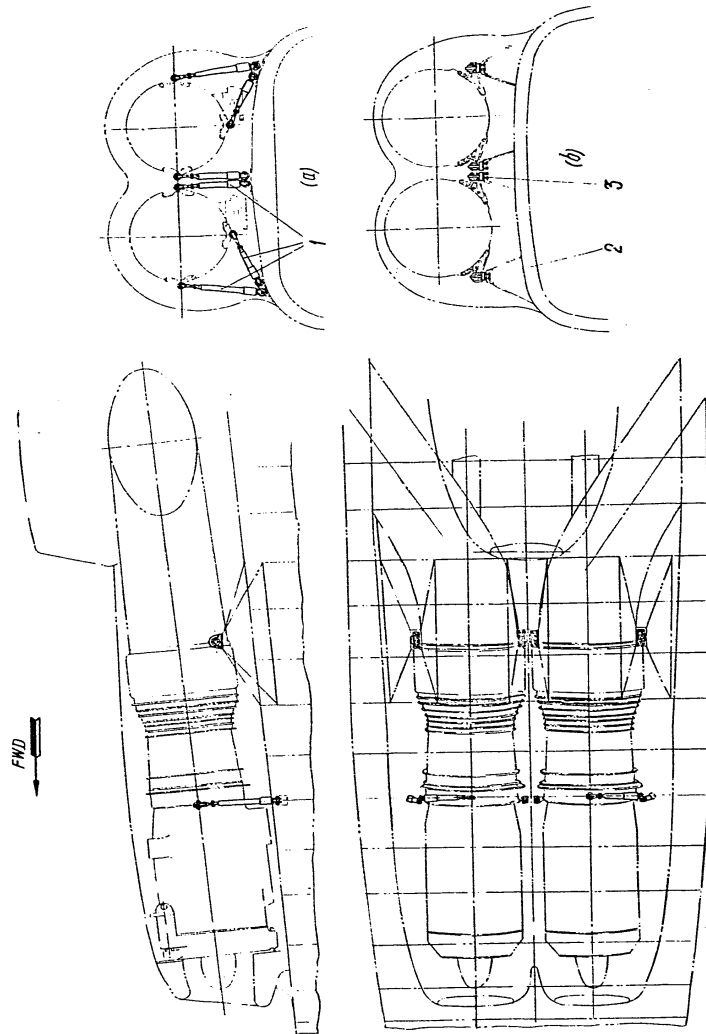


FIG. 123. DIAGRAM SHOWING ATTACHMENT OF ENGINES ON HELICOPTER
 a—engine attachment in front zone; b—engine attachment in rear zone; 1—adjustable struts; 2—bracket for outside engine attachment;
 3—bracket for inside engine attachment.

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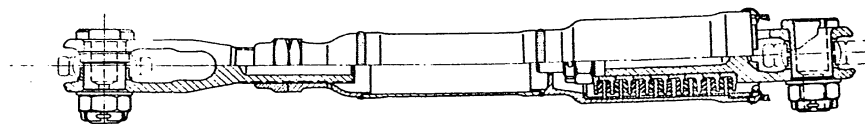


FIG. 124. ADJUSTABLE STRUT FOR ENGINE ATTACHMENT IN FRONT ZONE.

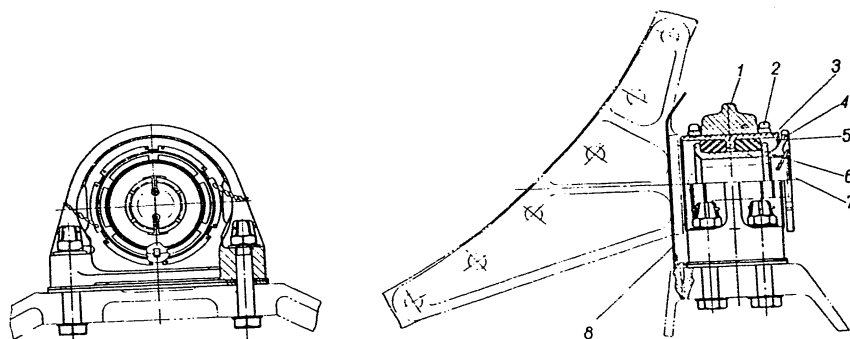


FIG. 125. BRACKET FOR OUTSIDE ENGINE ATTACHMENT IN REAR ZONE
1—body; 2—adjusting nut; 3—holder; 4—shaped nut; 5—damping ring; 6—washer; 7—sleeve; 8—heat insulating screen.

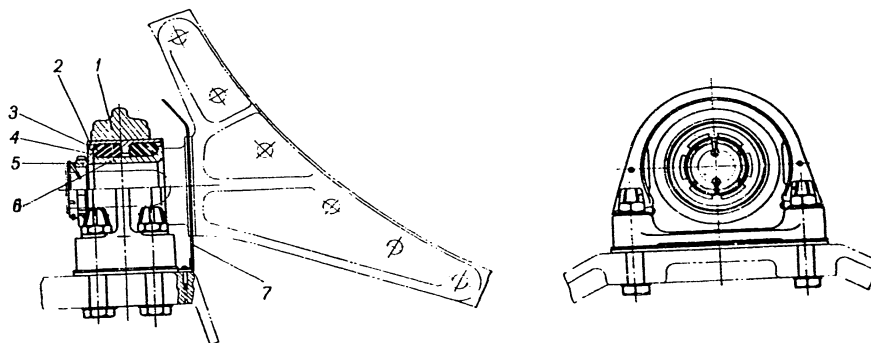


FIG. 126. BRACKET FOR INSIDE ENGINE ATTACHMENT IN REAR ZONE
1—body; 2—holder; 3—damping ring; 4—washer; 5—nut; 6—sleeve; 7—heat insulating screen.

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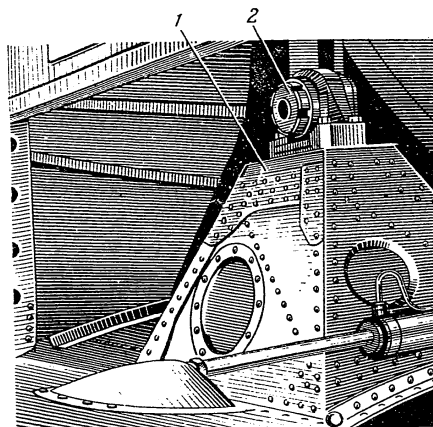


FIG. 127. REAR ZONE ENGINE ATTACHMENT UNIT
1-rear outside attachment unit stand; 2-rear outside attachment unit trunnion.

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Engine attachment in the rear zone is accomplished through the use of supports consisting of two brackets (Figs 125 and 126) each fastened by means of four bolts on special riveted duralumin stands 1 (Fig.127) constituting the elements of the fuselage structure. Fitted into the brackets on damping rings are distance sleeves receiving engine trunnions held in place by nuts.

Outer support nuts 2 (see Fig.125) allow engine fastening with regard to horizontal plane. To make it possible to adjust the engine in height, provision is made for special shims fitted under the brackets. A set of the shims is supplied with the helicopter.

Attachment of the engine in the front zone allows engine adjustment in vertical plane by changing the length of the struts.

Engine installation should be accomplished in strict compliance with the respective specifications (See the *Operating Instructions*)[®]

FUEL SYSTEM

The helicopter fuel system employs a two-line circuit and includes fuel tanks, fuel booster pumps, fuel measuring equipment, cut-off and fuel shut-off valves, drain cocks, coarse and fine fuel filters, connecting pipelines, non-return valves, and vent pipelines (Fig.128).

The main fuel supply is contained in eleven bag tanks which are connected so as to make up five groups:

Group I - tanks Nos 2 and 3	} Lower tanks
Group II - tanks Nos 4, 5, and 6	
Group III - tanks Nos 7 and 8	
Group IV - tanks Nos 9 and 10	} Upper tanks
Group V - tank No.11	

Stand-by tank No.1 (lower).

To provide for better centering of the helicopter, stand-by tank No.1 is emptied last but one via service tank No.11 when the latter contains only 400 kg of fuel.

Apart from the main bag tanks, the aircraft carries two external metal tanks, one tank at each side of the fuselage. Fuel from the external tanks flows by gravity into tank No.7 (group III).

Each of the tank groups, as well as the stand-by tank accommodates electric booster pumps transferring fuel from the lower tanks to the upper ones. The pumps enclosed in the upper tanks serve for building up the required pressure upstream of the engine pumps.

Booster pumps IHB-2 are installed inside tanks Nos 1, 2, 3, 4, 6, 7, 8, and 11 (Figs 128, 129, and 130). Tank No.9 mounts an external booster pump - unit 463 (Figs 128, 131, and 132).

Installed between the booster pumps and the non-return valves of the upper group tanks are pressure warning units CII-I6A designed for closing the electric circuit thus causing the warning light on the flight engineer's control panel to come on; this will indicate that the booster pumps of these tanks are in operation.

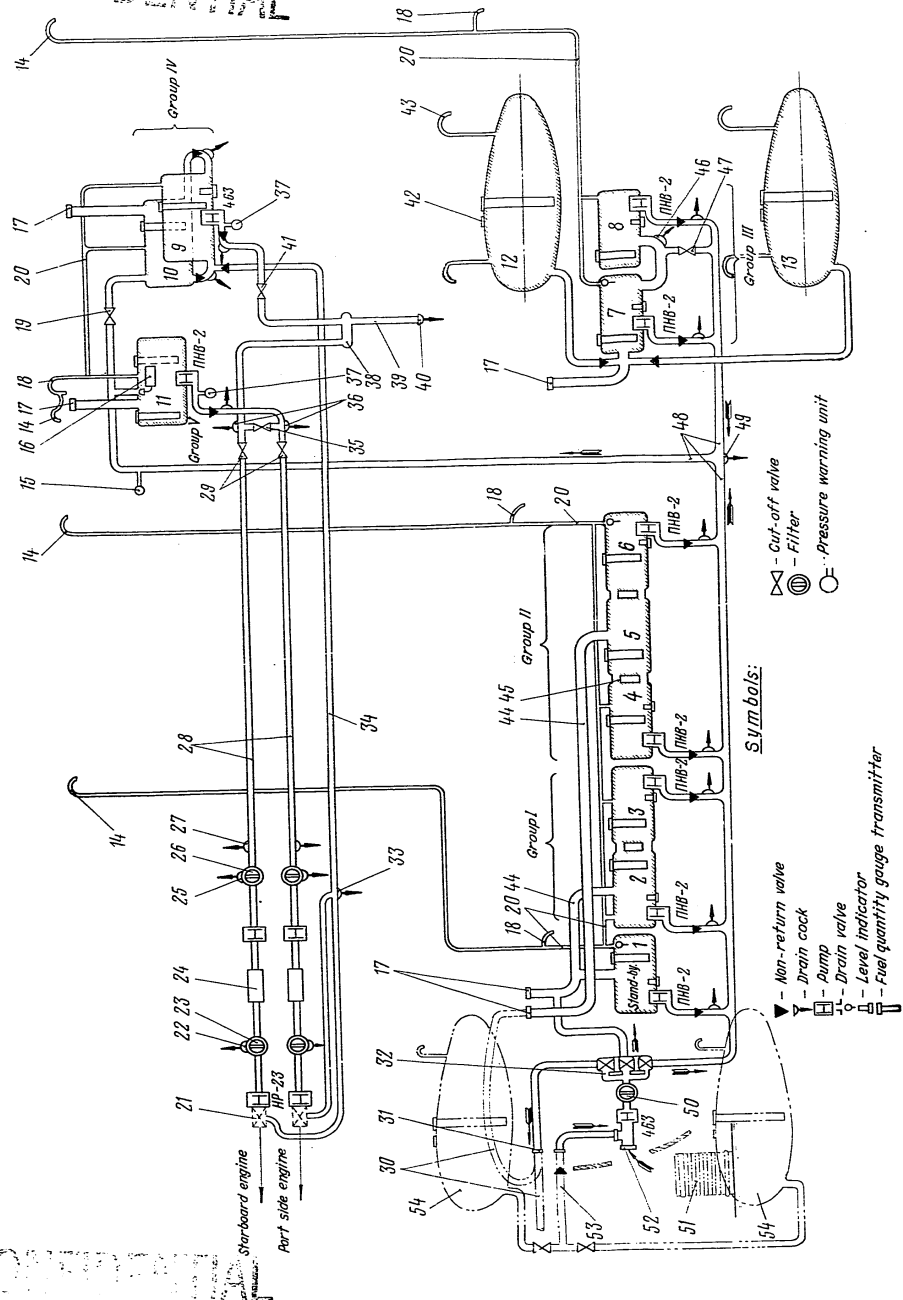
To check the booster pump operation in the lower group tanks, use is made of pressure warning unit CII-29A incorporated in the main fuel transfer line running through the gear box compartment.

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FIG. 128. FUEL SUPPLY SYSTEM SCHEMATIC DIAGRAM

1—standby fuel tank; 2, 3, 4, 5, 6, 7, and 8—lower fuel tanks; 9, 10, and 11—upper fuel tanks; 12 and 13—pressure warning unit (PWU); 14—pipeline for heating vent pipe with hot air; 15—pressure warning unit (PWU); 16—float valve; 17—filler; 18—outboard refuelling unit; 19—vent pipeline; 20—engine stop cock; 21—cock for draining sediment from fine fuel filter; 22—fine fuel filter; 23—fine fuel filter; 24—fuel flowmeter (FFM); 25—cock for draining sediment from coarse fuel filter; 26—coarse fuel filter; 27—cock for draining sediment from pipeline; 28—fuel feed pipeline; 29—fuel shut-off valves; 30—connecting hose for refuelling second group tanks from helicopter-carried containers; 31—fuel dispensing union; 32—fuel transfer way cock; 33—cock for draining fuel from pipeline; 34—pipeline for draining fuel from engine stop cocks into tank; 35—cut-off valve; 36—air bleed valves; 37—fuel pressure warning unit (PWU); 38—fuel manifold; 39—pipeline for draining fuel from upper tanks; 40—cock for draining fuel from upper tanks; 41—cut-off valve for independent draining of fuel from fourth and fifth group tanks; 42—external tank filter; 43—external tank vent pipeline; 44—refuelling pipeline; 45—vent connection between first and second group tanks; 46—cock for draining sediment from connecting pipeline and for draining fuel from third group tanks; 47—cut-off valve for refuelling third group; 48—fuel transfer pipeline; 49—cock for draining fuel from lower tanks; 50—coarse fuel filter; 51—ground fuel container; 52—union for fuel delivery from ground containers; 53—union and hose for fuel transfer from helicopter-carried containers when on ground or in flight; 54—helicopter-carried containers.

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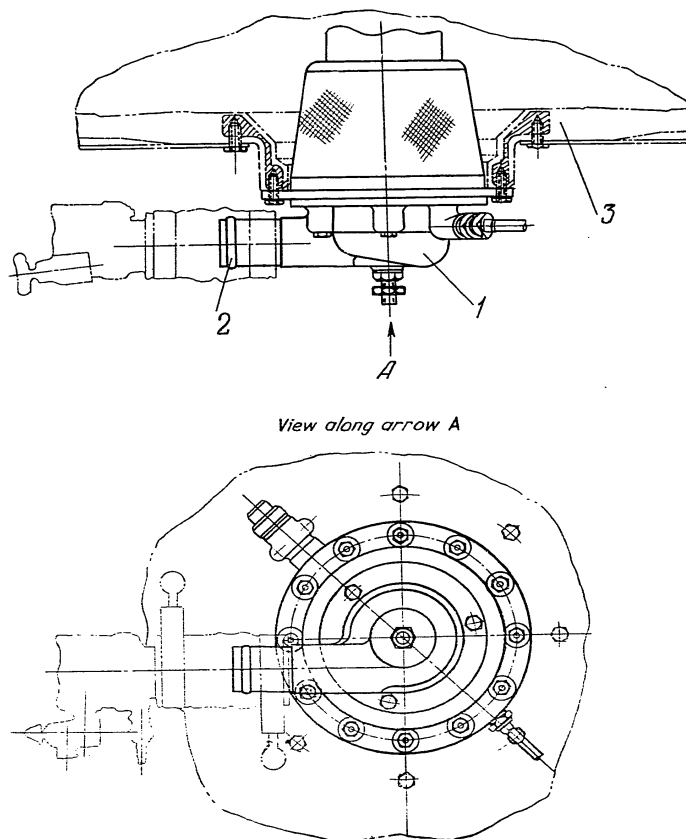


FIG. 129. ARRANGEMENT OF FUEL BOOSTER PUMP IHB-2 INSIDE TANK
1-pump IHB-2; 2-outlet pipe connection; 3-fuel tank.

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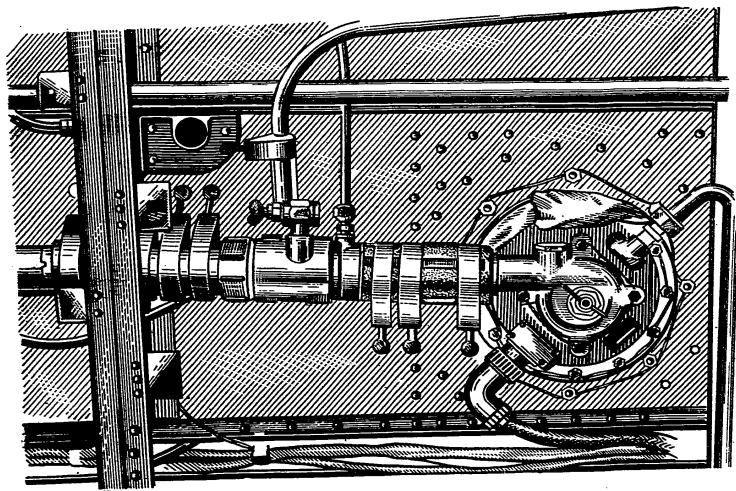


FIG. 130. FUEL BOOSTER PUMP IHB-2 ARRANGED INSIDE TANK.

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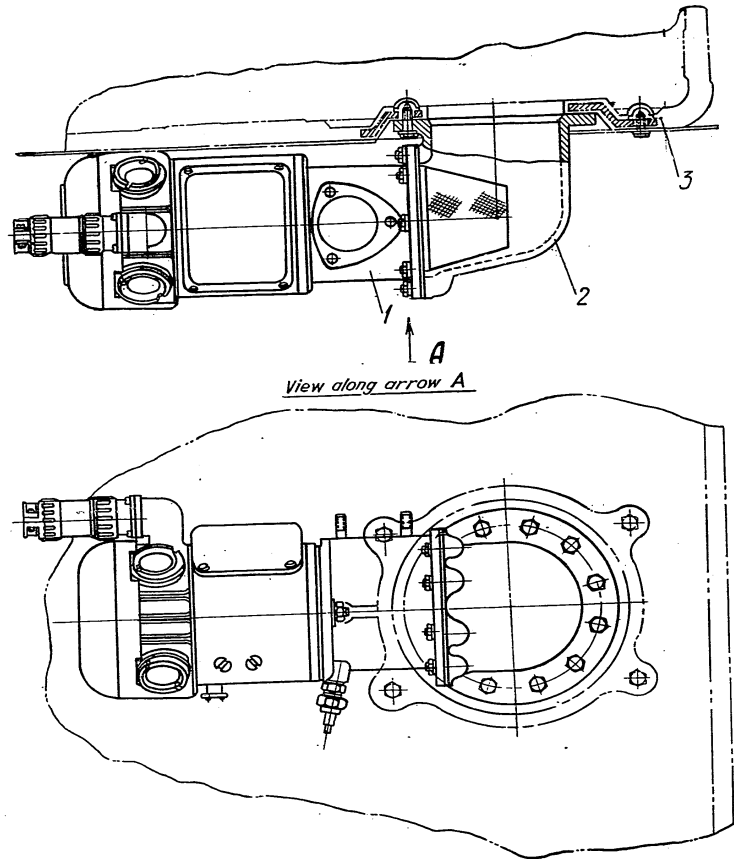


FIG. 131. ARRANGEMENT OF FUEL BOOSTER PUMP (UNIT 463) ON TANK NO.9
1—pump (unit 463); 2—pipe connection, 3—fuel tank No.9.

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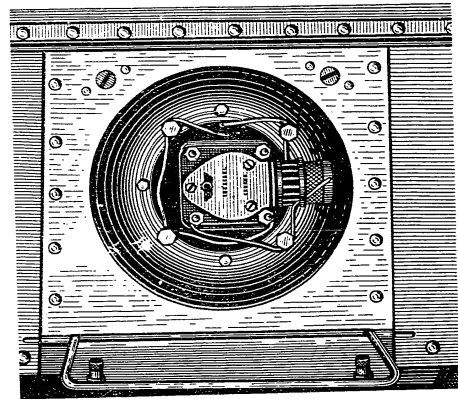


FIG. 133. FUEL LEVEL WARNING UNIT INSTALLED IN TANK NO. 9.

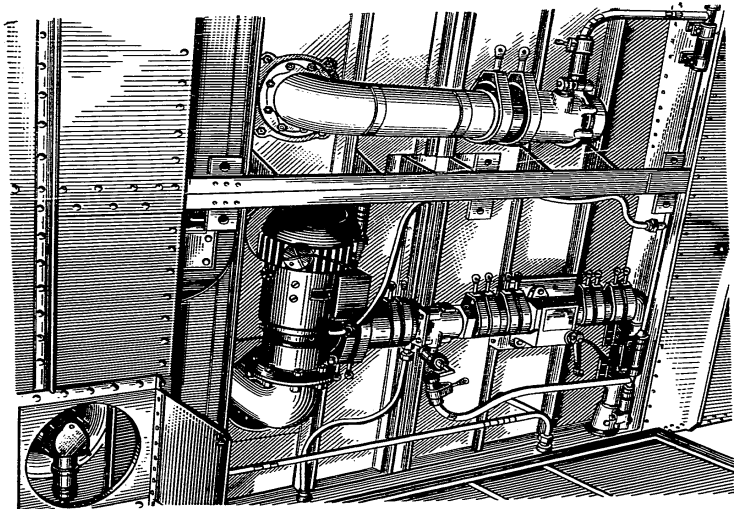


FIG. 132. FUEL BOOSTER PUMP (UNIT 463) INSTALLED ON TANK NO. 9.

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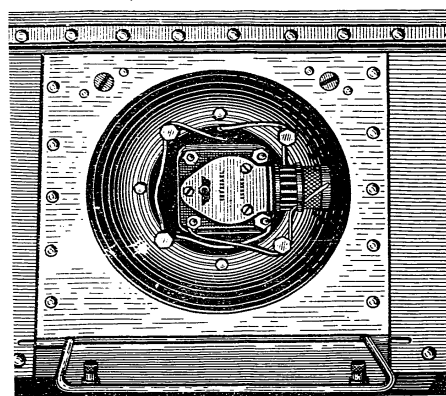


FIG. 133. FUEL LEVEL WARNING UNIT INSTALLED IN TANK NO. 9.

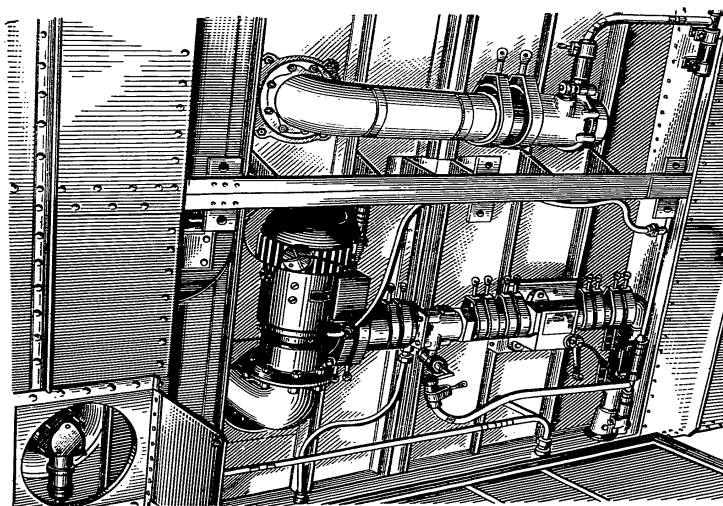


FIG. 132. FUEL BOOSTER PUMP (UNIT 463) INSTALLED ON TANK NO. 9.

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Every tank is furnished with one fuel quantity gauge transmitter, whereas tank No.11 has two such transmitters. Installed in the lower parts of tanks Nos 1, 2, 3, 4, 6, 7, 8, and 9 are fuel level warning units which stop the pumps when the tanks contain no more fuel.

Provided at the booster pump outlets are non-return valves which prevent fuel flow from the system via a defective tank.

SUPPLY OF FUEL INTO ENGINES

Fuel is supplied into the engines first from tank No.9, where it flows by gravity from tank No.10, and then from service tank No.11.

This means that fuel from all the tanks (tanks Nos 9 and 10 exclusive) is transferred by the pumps into tank No.11 which is furnished with a special float valve preventing an overflow when fuel is being pumped.

During the transfer, the fuel contained in external tanks flows by gravity into tank No.7 (group III).

Fuel consumption from the tanks, as well as sequence of booster pump engagement and disengagement is automatically controlled by fuel quantity gauge C9TC-230A so as to preserve helicopter centering within the specified limits.

When in the operating position, cut-off valve 35 (Fig.128) and cut-off valve 41 of tanks Nos 9 and 10 should be open and locked.

Prior to starting the engines, it is necessary to open the fuel shut-off valves and to bleed air through valves 36 arranged near frame No.17 under the cargo compartment ceiling.

To preserve helicopter centering within an optimum range, the booster pumps are automatically engaged and fuel is consumed from the tanks in the following sequence:

1. A booster pump (unit 463) mounted on tank No.9 is started, which causes fuel from tanks Nos 9 and 10 to flow into fuel manifold 38, whence fuel is carried through valve 35 and fuel shut-off valves 29 to the engines in pipelines 28.

Due to low arrangement of fuel manifold 38, no air is drawn from tank No.9 which provides for trouble-free supply of fuel into the engines no matter whether the booster pump of tank No.11 is in operation or not.

2. After fuel from tanks Nos 9 and 10 has been used up, the fuel level warning unit (Fig.133) disengages the pump of tank No.9 and starts the pumps accommodated in tanks Nos 7 and 11.

Now, the pump of tank No.7 delivers fuel along pipelines 48 into service tank No.11 until the entire amount of fuel is drawn from tanks Nos 7 and 8, as well as from the external tanks (if available). The pump of tank No.11 is running at all times.

3. After there is no more fuel left either in tanks Nos 7 and 8 or in the external tanks (if provided), the fuel level warning unit installed in tank No.7 cuts off the booster pump of this tank and starts the pump of tank No.4 to transfer fuel from tanks Nos 4, 5, and 6 into tank No.11.

4. After fuel from tanks Nos 4, 5, and 6 has all been spent, the fuel level warning unit enclosed in tank No.4 operates to cut out the pump of this tank and engage that of tank No.2. As a result, fuel from tanks Nos 2 and 3 will be pumped into tank No.11.

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5. As soon as fuel from tanks Nos 2 and 3 has been consumed, the fuel level warning unit picks up to disengage the pump of tank No.2. This done, fuel will be delivered into the engines from tank No.11 until the contents of the latter drops off to 400 kg.

At this moment, the fuel level warning unit incorporated in the left-hand fuel quantity gauge transmitter of tank No.11 will start the pump of the stand-by tank, which will transfer fuel into tank No.11. After the stand-by tank is emptied, its pump will be disengaged by the tank fuel level warning unit.

6. When the amount of fuel in tank No.11 is reduced to 400 kg (the so-called emergency fuel remaining), a light panel will come on in the flight engineer's cabin.

With the helicopter hovering, when the lower group tanks contain an amount of fuel making the booster pumps of these groups (located in front tanks Nos 2, 4 or 7) emerge above the fuel level, the fuel level warning unit positioned near the pump will automatically disengage the latter, and, at the same time, will start the pump accommodated in tank No.3 or No.6, or No.8.

Should the helicopter pitch angle change, with resultant emerging of the pump in one of the rear tanks, this pump will be disengaged by the fuel level warning unit located nearby, whereas the pump in the front tank of the same group (if sufficient fuel is present) will be started by the respective fuel level warning unit.

If the front and rear tank pumps emerge from the fuel at a time (i.e. when the tanks are emptied), all the pumps will be disengaged by the relevant fuel level warning units.

In case of automatic equipment failure, the booster pumps can be started manually, the sequence of pump engagement being the same as in the case of automatic operation. With the pumps started manually, the flight engineer must watch the readings of the fuel quantity gauge to evaluate the amount of fuel left in the tanks and to disengage the pumps as soon as the fuel has been consumed.

Note. Should it become necessary to draw fuel from the tanks in a sequence other than specified, the flight engineer can disengage or engage the fuel pump of any tank to consume fuel from the tanks in a different order.

The sequence of fuel consumption remains the same irrespective of the specific helicopter refuelling procedure, the pumps of empty tanks being kept out of operation. As soon as any group of tanks is emptied, the pump of this group should be disengaged.

As has been stated above, fuel from the tanks is fed to electric fuel shut-off valves 29 (Figs 128 and 134) designed for shutting off the engine set on fire or developing some defects in the pipeline. Thence the fuel is brought through coarse fuel filters (Figs 135 and 136) into the engine booster pumps (unit 707).

On leaving the pumps, the fuel flow passes through the transmitters of fuel flowmeters PTMC-I.6-B-I (Fig.137) and through fuel fine filters (Figs 136 and 138) to enter engine regulating fuel pumps HP-23A. These direct the fuel via stop cocks 21 into pipes led to both fuel manifolds.

Stop cocks 21 are connected to tank No.9 by a pipeline through which fuel is returned into the tank when the cocks are closed. The stop cocks are controlled through operation of handles located on the cabin ceiling above the pilot's head. The handles are linked to the pulleys, mounted on the cocks, by means of cables (Fig.139).

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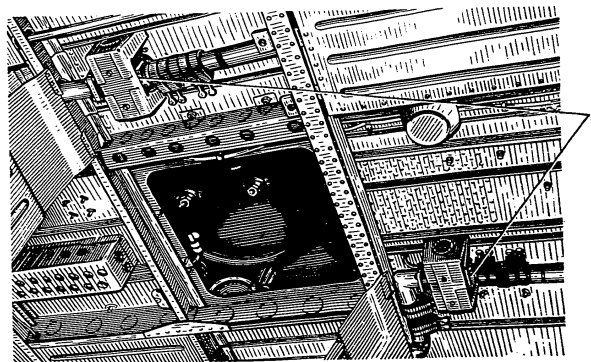


FIG. 134. FUEL SHUT-OFF VALVES INSTALLED BETWEEN FRAMES NOS 16 AND 17 ON CARGO COMPARTMENT CEILING
1—fuel shut-off valves.

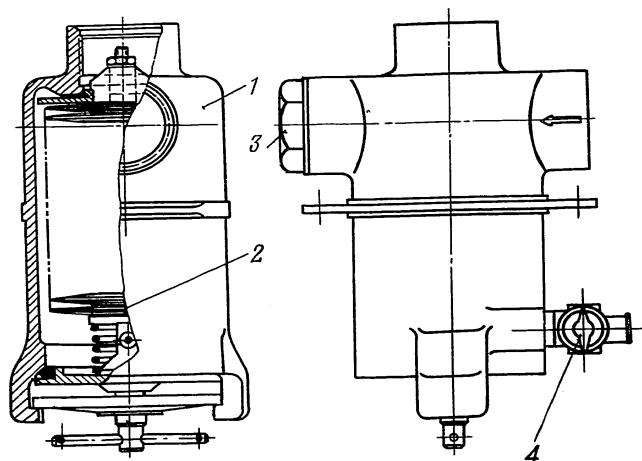


FIG. 135. COARSE FUEL FILTER
1—housing; 2—filtering stack TФ6-200; 3—screw plug; 4—drain cock.

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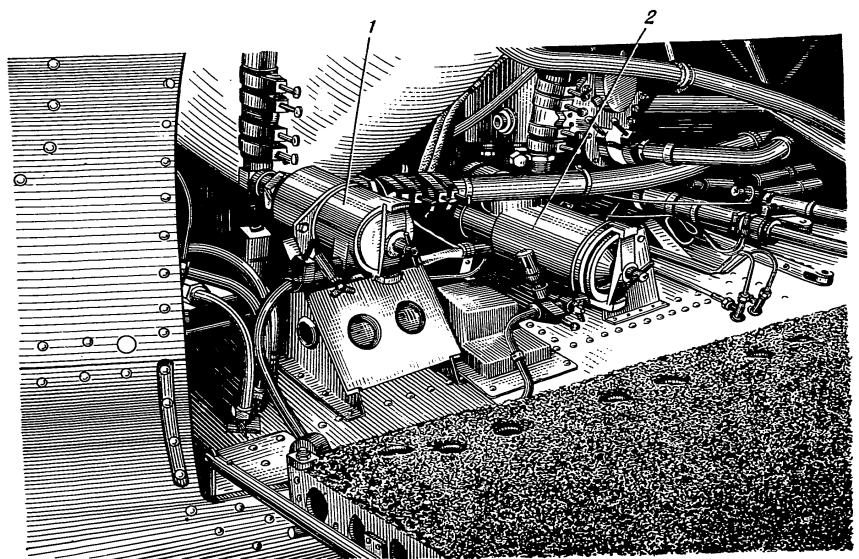


FIG. 136. PORT-SIDE ENGINE COARSE AND FINE FUEL FILTERS
1—coarse fuel filter; 2—fine fuel filter.

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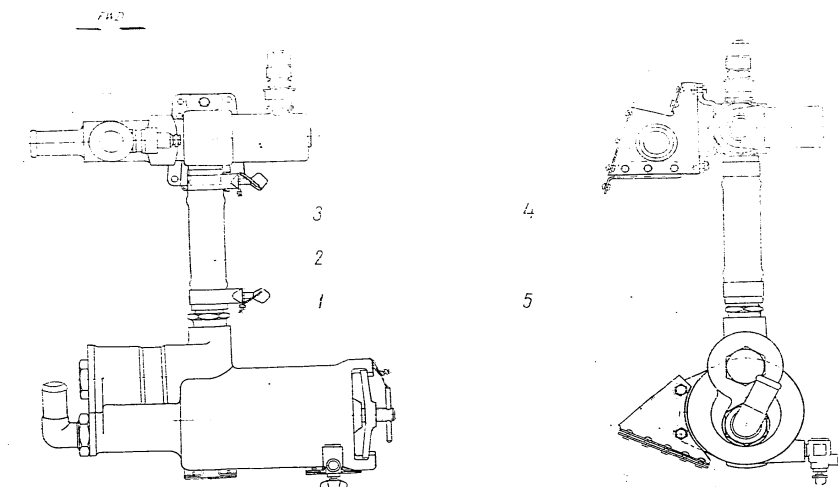


FIG. 137. ARRANGEMENT OF STARBOARD ENGINE FINE FUEL FILTER AND FUEL FLOWMETER
1-fine fuel filter; 2-coupling; 3-fuel flowmeter PTMC 1.8-4-1; 4-bracket; 5-bracket.

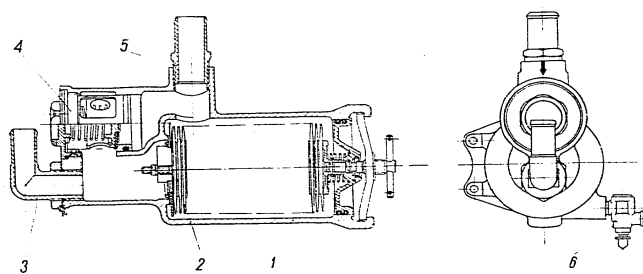


FIG. 138. FINE FUEL FILTER
1-housing; 2-filtering stack 350003; 3-elbow pipe; 4-by-pass valve; 5-fuel supply union; 6-drain cock.

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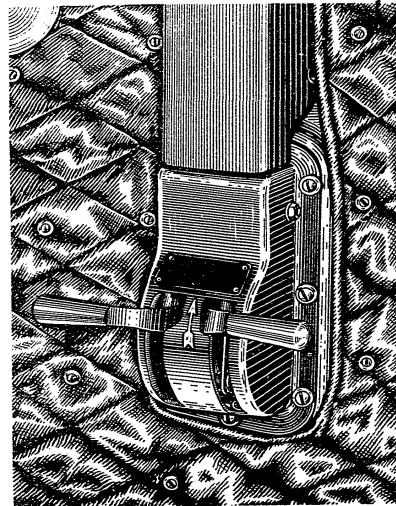


FIG. 139. ENGINE STOP HANDLES ON PILOT'S CABIN CEILING. (16)

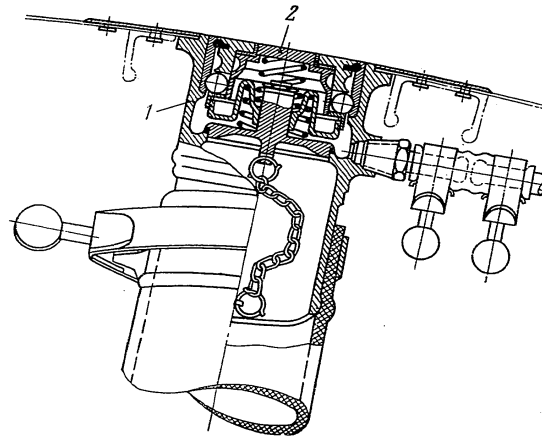


FIG. 140. FILLER
1-housing; 2-cover.

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The transmitters of fuel flowmeters PTKC 1.8-E-I are designed for measuring both fuel consumption at a given moment and total fuel consumption and for sending respective pulses to the instrument mounted on the flight engineer's control panel.

Fuel pressure is measured upstream of pump HP-23A with the aid of transmitter MPT-4 which is a component of set 2AM-4, and downstream of pump HP-23A (in the fuel manifold first stage), by transmitter MA-100 from set 3MVA-3PV. The above transmitters are arranged on the fire bulkhead (Figs 163 and 164).

CHECKING FUEL SUPPLY

Capacitance-type fuel quantity gauge CQTC-230A incorporated in the fuel system provides for measuring the quantity of fuel contained in the tanks, indicating emergency fuel remaining, automatically engaging and disengaging the booster pumps.

One fuel quantity gauge transmitter is installed in every tank, service tank No. 11 accommodating two transmitters, which provides for obtaining more accurate readings when the helicopter is rolling. Each external tank also contains one fuel quantity gauge transmitter. In case the helicopter does not employ external tanks, the respective fuel quantity gauge transmitters are substituted by simulators.

Fuel quantity gauge CQTC-230A provides for measuring both total amount of fuel held in the tanks and the amount of fuel contained in each tank group; it also ensures separate fuel amount readings for tank No. 1 and the starboard and port side external tanks.

REFUELLING^⑦

Helicopter refuelling may be accomplished in three ways: by airfield fuel servicing trucks, by the inboard refuelling unit from ground containers, and by the inboard refuelling unit from the helicopter-carried containers.

Fuel servicing trucks fill the tanks with fuel via five fillers (Fig. 140), two of which are located on top of the fuselage central part, at frame No. 26, and are designed for filling the upper tanks; tank No. 9 is filled by gravity from tank No. 10.

Lower tanks Nos 7 and 8 are filled through a separate filler arranged between frames Nos 17 and 18 on the helicopter starboard, tank No. 8 being filled via tank No. 7. Lower tanks Nos 1, 2, 3, 4, 5, and 6 receive fuel through two fillers located between frames Nos 2 and 3 on the starboard side of the fuselage. These tanks are filled through two fuelling pipes, on pipe per each tank group; branching from these pipes are fuel delivery connections running to tanks Nos 1 and 2 and to tank No. 5, respectively (Figs 128 and 141).

The external tanks are filled through their own fillers located in the front section of each tank.

If no fuel servicing trucks are available, the tanks may be filled with fuel from ground containers by using a special inboard refuelling unit arranged between frames Nos 2 and 3 in the starboard central part of the fuselage.

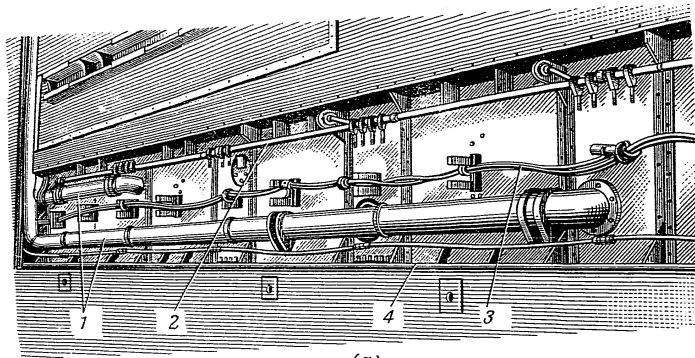
The inboard refuelling unit includes an electric pump (unit 463) and a fuel filter enclosed in a common housing with a three-way cock (Figs 142 and 143). Welded into the lower part of the filler pipe for tanks Nos 1 and 2 is an elbow pipe receiving the pipeline led from the inboard refuelling unit.

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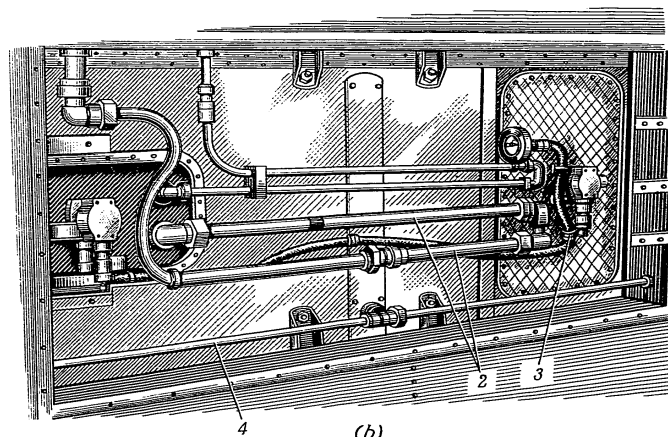
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(a)



(b)

FIG. 141. ARRANGEMENT OF FUEL TANK CONTAINERS AND PIPELINES UNDER CARGO COMPARTMENT FLOOR

(with removable floor panel lifted up)

a—containers of tanks Nos 1, 2, 3, 4, 5, and 6; b—containers of tanks Nos 7 and 8; 1—refuelling pipes; 2—vent pipeline; 3—electric wiring led to fuel quantity gauge transmitters and to fire alarm system; 4—fire-fighting system sprinkling pipes.

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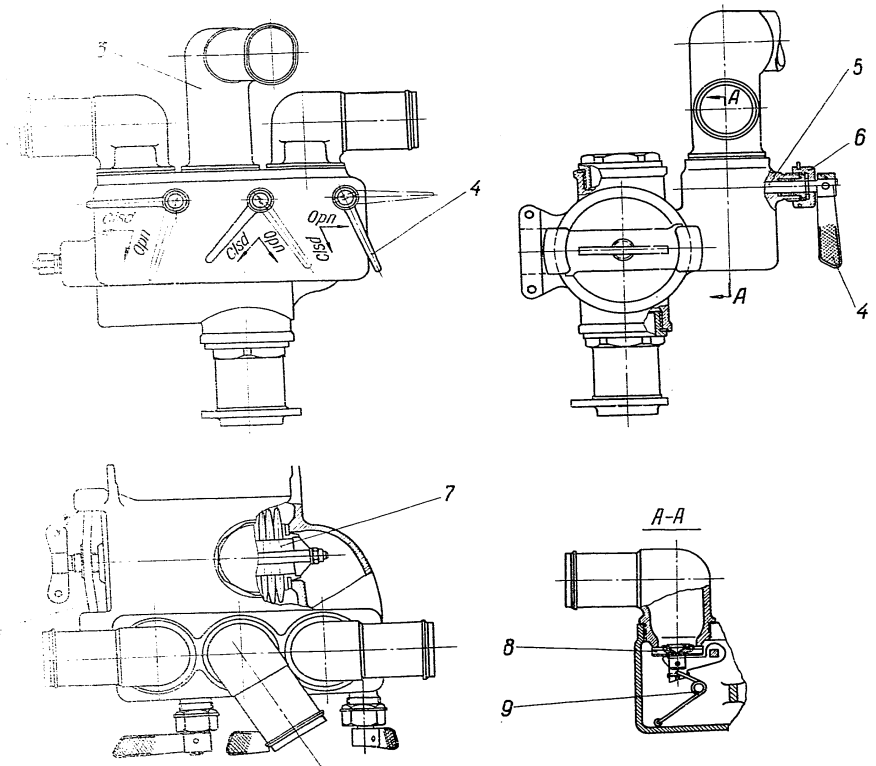


FIG. 142. THREE-WAY COCK WITH FILTER
1-housing; 2 and 3-elbow pipes; 4-three-way cock handles; 5-axle; 6-gland nut; 7-filtering stack; 8-valve;
9-sprigg; 10-filter cover.

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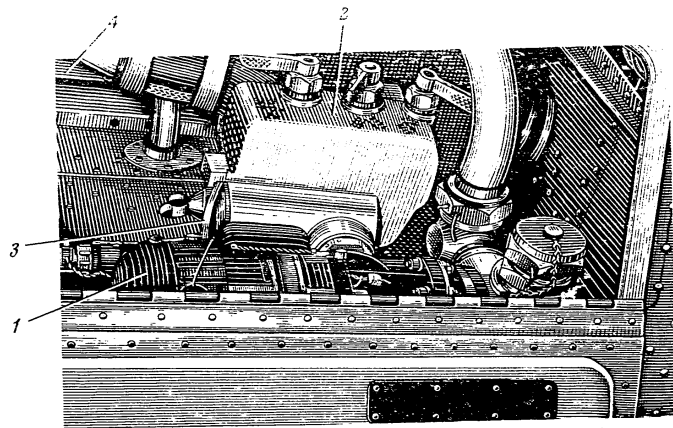


FIG. 143. ARRANGEMENT OF INBOARD REFUELLING UNIT
1—electric pump (unit 463); 2—three-way cock housing; 3—filter (enclosed in common housing with three-way cock); 4—pump starting tumbler switch.

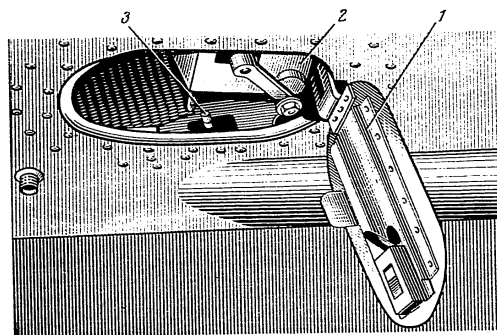


FIG. 144. THIRD GROUP TANK FUEL CUT-OFF VALVE
INTERLOCKED WITH WARNING LIGHT BY MEANS OF
LIMIT SWITCH
(with hatch door open)
1—hatch door; 2—fuel cut-off valve; 3—limit switch.

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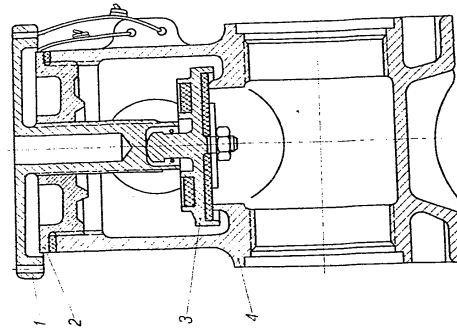


FIG. 146, DRAIN COCK
1-handle; 2-cover; 3-valve
with rubber gasket; 4-hous-
ing.

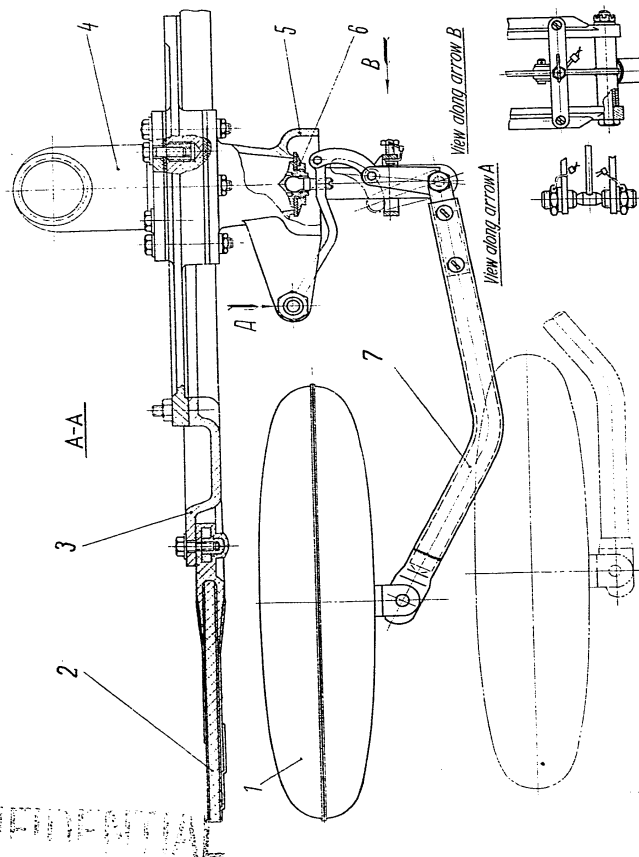


FIG. 145, REFUELLING FLOAT VALVE ARRANGED IN TANK NO.11
1-float; 2-tank wall; 3-plate; 4-T-piece; 5-valve housing; 6-plate valve;
7-lever.

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The inboard refuelling unit is capable of transferring fuel from ground containers into the lower, upper, and external tanks or to another helicopter. The same equipment can be employed for dispensing fuel to consumers, in case the helicopter is used as a flying tank.

Prior to refuelling, connect the hose to union 52 (see Fig.128) of the inboard refuelling unit, the other end of the hose being lowered into a ground container; this done, open the respective valve of the inboard refuelling unit by hand and start the pump.

To fill lower tanks Nos 1, 2, and 3, open the middle valve of the inboard refuelling unit, thereby causing fuel to flow along the pipeline led from the inboard refuelling unit to the filling pipe of the above-specified tanks.

Filling of lower tanks Nos 4, 5, and 6 (Group II) is accomplished with the aid of special connecting hose 30, which is attached to fuel dispensing union 31 of the inboard refuelling unit, the other end of the hose being lowered into the filler of this group. To proceed to refuelling, open the inboard refuelling unit left-hand valve; this will cause fuel from the refuelling unit to flow via the dispensing union and the connecting hose to the filler of these tanks.

To fill lower tanks Nos 7 and 8, open the right-hand valve of the inboard refuelling unit and special valve 47 (Figs 128 and 144) located between frames Nos 18 and 19 in the lower part of the fuselage. After refuelling is completed, do not fail to close this valve, otherwise, with the booster pumps in the first and second group tanks running, fuel will be transferred into tanks Nos 7 and 8 instead of tank No.11. These tanks will be overfilled, and excess fuel will be discharged overboard.

To avoid this, provision is made for indicating the open position of the valve which is fitted with a switch located nearby. When the valve is being opened, the handle will depress limit switch 3, thereby causing a light panel on the flight engineer's control panel to come on; this will indicate that the valve is in the open position.

To fill the upper tanks, open the right-hand valve of the inboard refuelling unit and special out-off valve 19 to fill tanks Nos 9 and 10 (see Fig.128); the valve is installed between frames Nos 22 and 23 in the upper part of the fuselage.

With the valves open, fuel from the inboard refuelling unit will be sent simultaneously into tanks Nos 10 and 11, tank No.9 being filled with fuel flowing from tank No.10.

As soon as these tanks are filled to capacity, the level transmitters located in the upper part of the fuel quantity gauge transmitters will give respective indications. Apart from this, tank No.11 has a float valve (Fig.145) which safeguards the tank against overfilling while both refuelling and in flight, with the booster pumps of the lower tanks running.

Tanks Nos 9 and 10 are furnished with no such valves since they do not receive any fuel when airborne, the refuelling pipeline being disconnected by valve 19.

The refuelling procedure completed, close valve 19, otherwise the sequence of automatic fuel consumption from the tanks while in flight will be affected. The open and closed positions of the valve are indicated by a signalling system.

To fill a fuel container carried on board the helicopter, it is necessary to open the left-hand valve of the inboard refuelling unit and fit the end of the connecting hose into the container to be filled.

Helicopter refuelling over, disconnect the receiving hose, fit the union with a tight plug, and lock the latter.

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Now, to fill the tanks by the use of the inboard refuelling unit drawing fuel from the helicopter-carried container, open the inboard refuelling unit valve used for filling the respective tank group, and switch on the electric pump; as a result, fuel will flow from container 54 (see Fig.128) via a non-return valve and the filter right into this group tanks.

The above-indicated refuelling procedure may be used on the ground only. When airborne, it is tank No.11 alone that can be filled from the helicopter-carried container.

The same inboard refuelling equipment may be employed for dispensing fuel to consumers in the event the helicopter is used as a flying tank.

FUEL DRAINING

Fuel is drained from the system through drain cocks whose construction is illustrated in Fig.146.

From the upper tanks fuel is drained via cock 40 (Figs 128 and 147) arranged near frame No.20 at the fuselage starboard. To drain fuel from the lower tanks, use is made of cock 49 located near frame No.14 at the fuselage bottom, front of the cargo compartment flooring central hatch (Fig.148). The same cock serves for draining fuel from the external tanks.

Booster pumps IHB-2A may be switched on for draining fuel at an accelerated rate.

The fuel system provides for draining fuel from the fourth and fifth tank groups separately. For draining fuel from tank group IV, close electric fuel shut-off valves 29 (see Fig.128) and cross-feed valve 35; this done, open drain cock 40. Cut-off valve 41 is always open.

To drain fuel from tank No.11, close electric fuel shut-off valves 29 and cut-off valve 41 of tank group IV; next, open drain cock 40. As soon as fuel is completely drained from tank No.11, re-open cock 41.

Sediment accumulating in the tank is drained prior to flight through drain cocks built into the lower covers of booster pumps IHB-2A and through drain cocks located in the lowermost points of the fuel system.

VENT SYSTEM

The vent system of the lower tanks (groups I and II) and tank No.1 employs a common pipeline made of aluminum alloy, individual pipes being connected by nipple joints. Vent pipes 18 (see Fig.128) are led through the skin overboard at frames Nos 2 and 14. The vent pipe of the tanks making up group III are led overboard at frame No.22.

The upper tanks are vented through a common pipeline whose connection is brought through the skin overboard, too.

To protect the vent pipe outboard ends against ice formation, provision is made for the following: the vent pipelines led overboard receive pipes whose other ends communicate with the gear box compartment in which air pressure and temperature are increased due to operation of the fan. This provides for blowing the vent pipelines with warm air thus preventing them against icing.

The external tanks are vented through pipes 43.

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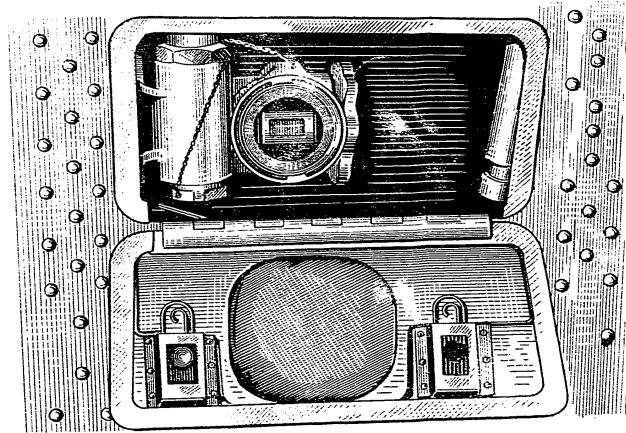


FIG. 147. COCK FOR DRAINING FUEL FROM UPPER TANKS, INSTALLED NEAR FRAME NO. 20 AT FUSELAGE STARBOARD (with hatch door open).

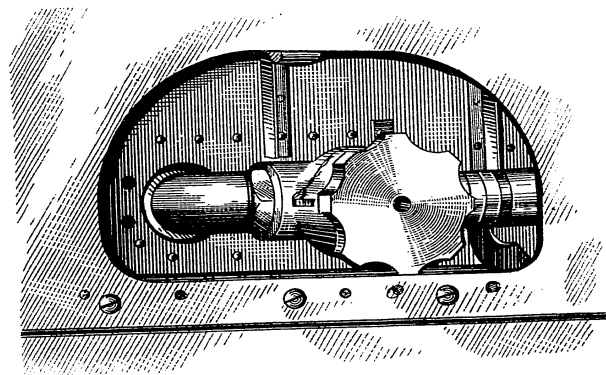


FIG. 148. COCK FOR DRAINING FUEL FROM LOWER TANKS, INSTALLED NEAR FRAME NO. 14, FRONT OF CARGO COMPARTMENT FLOORING CENTRAL HATCH.

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FUEL TANKS

The main fuel tanks are fabricated from two layers of rubber (grade 2035) each 0.7 mm thick. On top, the rubber is covered with a protective layer of rubber-impregnated caprone (IIMK300). The lower parts of the upper tanks are protected by two layers, and the upper parts, by one layer of 5 mm-thick rubber, grade P-29.

All bag tanks are subjected to tests for tightness in special grid containers at a pressure of 0.2 kg/sq.cm, Gauge.

Tanks Nos 1, 2, 3, 4, 5, and 6 (Fig.149), of the same capacity, are accommodated in special containers between frames Nos 2 and 14 under the floor of the fuselage central part, tanks Nos 7 and 8 being located between frames Nos 18 and 22.

The containers and protected on top by detachable panels that cover the refueling, venting, and fire-fighting pipelines and the electric wires running to the fuel quantity gauge transmitters and to the fire alarm system (Fig.141).

Tank installation is accomplished from inside the cargo compartment. To allow this, every container is provided with a rectangular cutout, through which the tank is introduced and installed. The cutout is closed on top with panels and the tank plate which serves for attaching the tank to the container. Besides, the upper wall of the tank is held to the upper sheet of the container by special pins, some of which are cured into the upper wall of the tank, and the other, riveted to the plates that are bound to special covers sewn and cemented to the tanks (Fig.149). To facilitate tank installation, the pins are provided with holes receiving the wire by means of which the pins are slipped into the respective holes in the container.

The upper tanks are arranged in containers located above the ceiling of the cargo compartment. Front tank No.11 (Fig.150) is mounted between frames Nos 19 and 22, and two rear longitudinal tanks Nos 9 and 10 (Fig.151), between frames Nos 22 and 26.

The upper tanks are mounted from the side of the fuselage tail boom after removing the container rear wall on frame No.26; installation of tank No.11 also involves removal of the front wall of the rear tank container on frame No.22. Attachment of the upper tanks is similar to that of the lower tanks.

Arranged at the fuselage sides in the vicinity of frames Nos 12 and 21 (outboard the lower part of the cargo compartment) are two external metal tanks equal in capacity (see Fig.152).

The cylindrical external tanks (Fig.153) are welded of sheet material, grade AMU, amounting to 2 mm in thickness. The tank framework comprises two stressed and eight intermediate frames made of material AMU. Besides, the tank has three duralumin partitions provided with flanged holes; two double partitions are arranged in the stressed frame plane, and one single-walled partition, in the middle frame plane.

Located in the upper part of the tank are a filler and a vent unions, the tank lower part being provided with a union and an elbow designed for letting out the fuel into engines.

The tank shell is secured to the frames by means of spot welding technique; the shell sheets are interconnected by argon-arc welding, whereas the attachment fitting flanges are held to the tank by oxy-acetylene welding.

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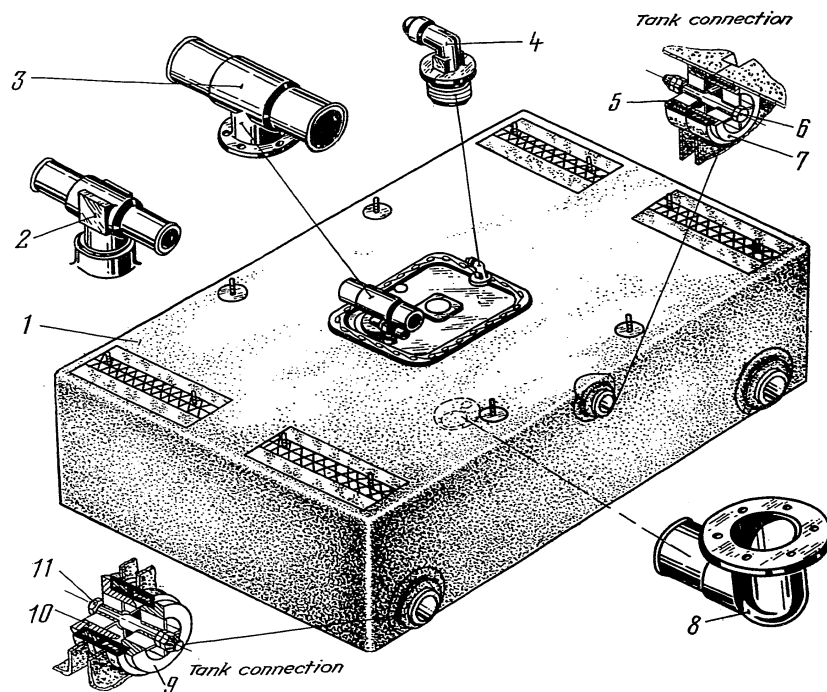


FIG. 149. LOWER FUEL TANK

1-fuel tank; 2-vent pipe T-piece; 3-fuelling pipe T-piece; 4-elbow; 5,7,9, and 10-flanges; 6 and 11-bolts with nuts; 8-fuel outlet elbow.

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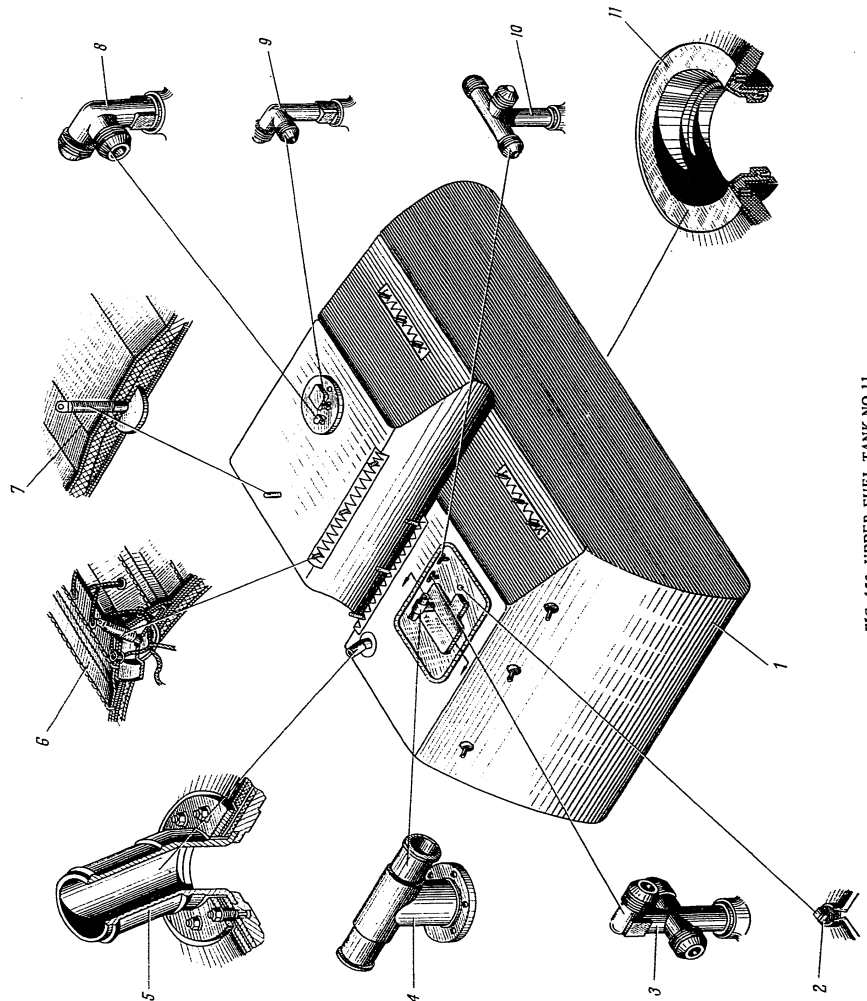


FIG. 150. UPPER FUEL TANK NO. 11
 1—fuel tank; 2—plug; 3—vent pipeline spider; 4—transfer pipeline T-piece; 5—filter; 6—pins attached to tank by cords; 7—pins cured into tank; 8—vent pipe—line T-piece; 9—T-piece; 10—spider; 11—flange for attachment of booster pump [11]-2.

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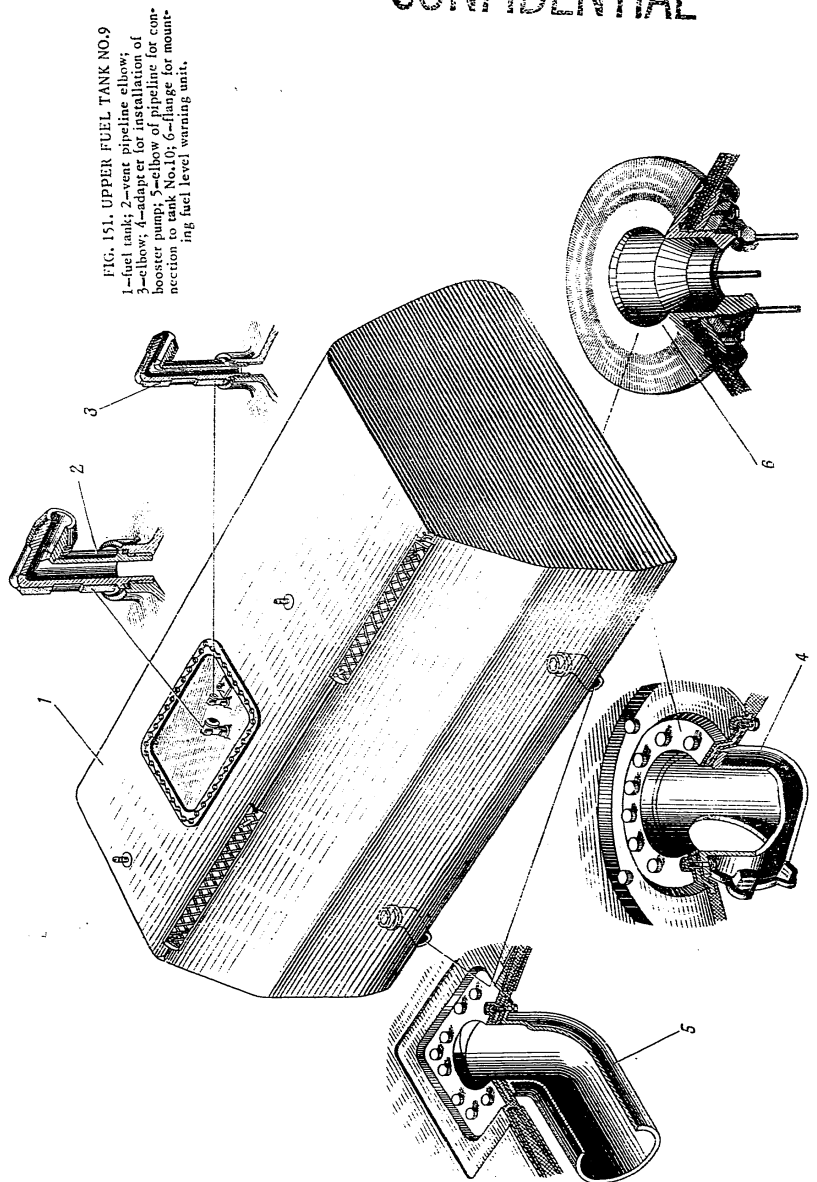


FIG. 151. UPPER FUEL TANK NO. 9
1—fuel tank; 2—vent pipeline elbow;
3—elbow; 4—flange for installation of
booster pump; 5—elbow of pipeline for con-
nection to tank No. 10; 6—flange for mount-
ing fuel level warning unit.

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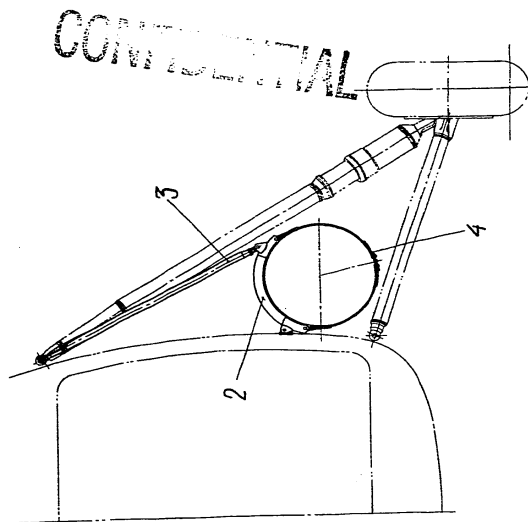
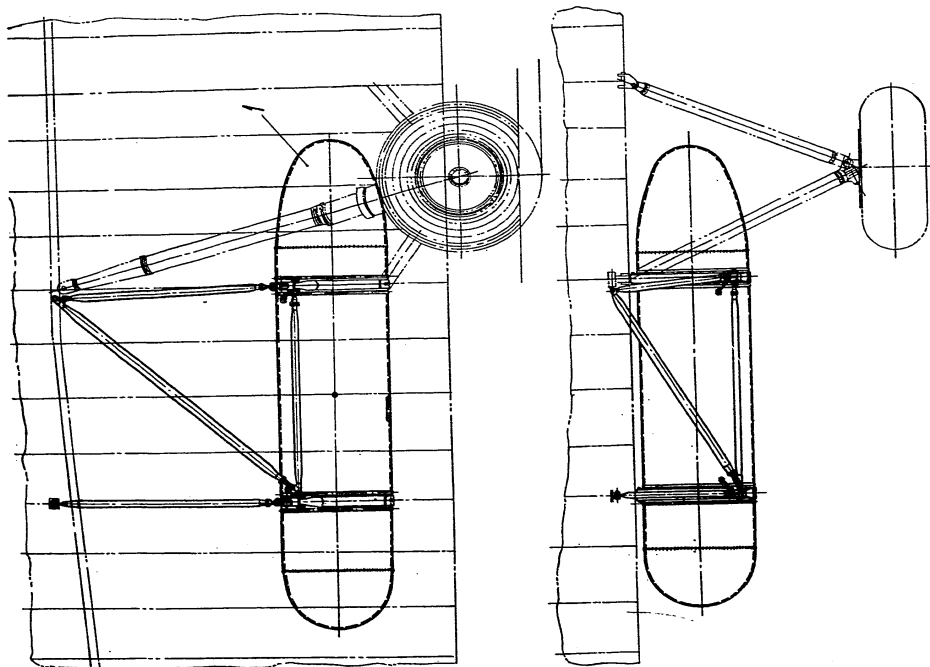


FIG. 152. EXTERNAL TANK INSTALLATION DIAGRAM
1-tank; 2-tank attachment seat; 3-tank attachment brace strut;
4-tank yoke band.



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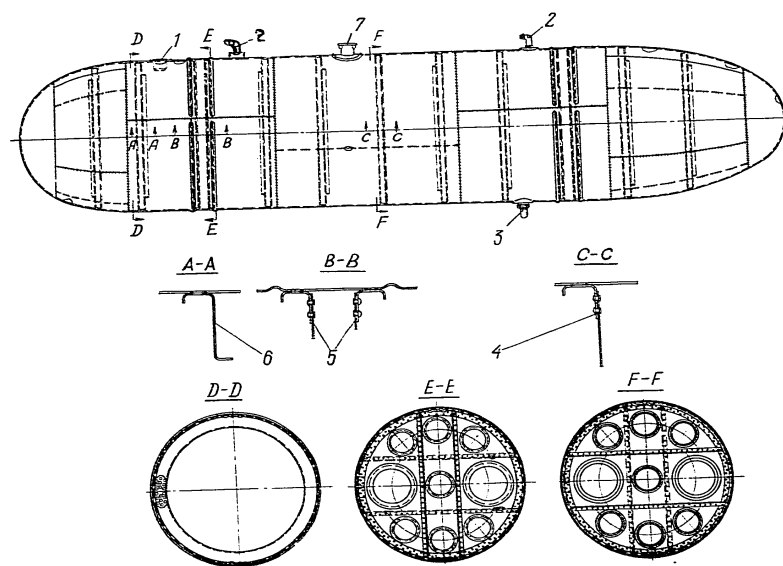


FIG. 153. EXTERNAL FUEL TANK
 1—filler; 2—vent union; 3—fuel outlet union; 4—central partition; 5—stressed frame; 6—intermediate frame; 7—flange for attachment of fuel quantity gauge transmitter.

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The external tanks are secured to special detachable seats suspended from the fuselage sides with the aid of brace struts.

The brace struts are manufactured from duralumin tubes whose ends carry steel forked and lugged tips. The tank seats are stamped of a 2-mm duralumin sheet; riveted at their ends are steel welded units receiving the tank yoke bands that are secured to the unit bottom by eye bolts with distance sleeves.

The upper parts of these units, coming in contact with the fuselage sides, are fitted with forks attached to mating eyes which are installed on frames Nos 14 and 18 in the central part of the fuselage.

The external welded units of the tank seats are furnished on their top with eyes receiving the brace strut tips secured by bolts. The upper ends of the brace struts carry tips which are bolted, too; the front brace strut tip is attached to the unit installed on frame No.14, and the rear brace strut tip, to the upper unit of the diagonal brace strut.

The eye bolts, with the yoke band ends slipped onto them, are interconnected by means of a link whose front end is secured to the diagonal brace strut; the other end of this brace strut is fastened to the forked bolt serving for attachment of the L.G. shock strut upper cardan.

The tank yoke bands are made of stainless steel X18H4T9-H, 1.2 mm thick, and are furnished with turnbuckles allowing adjustment of band tension¹⁹. The seats and yoke bands are aligned with the stressed frames of the tank.

Arrangement of the external tanks and their attachment fittings are illustrated in Figs 152, 154, and 155.

PIPELINES

The pipelines employ piping AMT-M of the following diameters:

Refuelling pipelines 67 x 70 mm

Main fuel pipelines and pipelines used

for refuelling by means of inboard refuelling

unit 36 x 38 mm

Pipelines affording communication between

external tanks 36 x 38 mm

Vent pipelines 20 x 22 mm

10 x 12 mm

Pipelines supplying fuel to engines and

fuel flowmeters 28 x 30 mm

25 x 27 mm

20 x 22 mm

Sediment discharge pipelines 8 x 10 mm

6 x 8 mm

4 x 6 mm

Pressure warning unit pipelines. 4 x 6 mm

As a rule, pipelines are connected by means of durite hoses secured by clamping collars. The fuel system units and attachment fittings are, for the most part, held in place with the aid of bolts and flanges.

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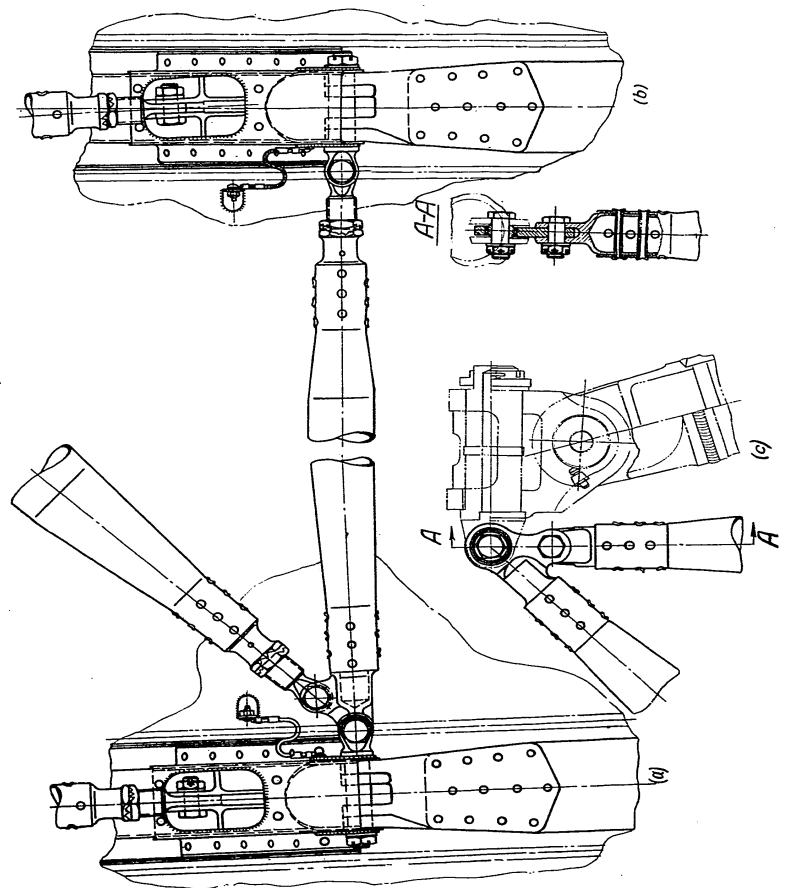


FIG. 154. EXTERNAL TANK ATTACHMENT UNITS
a--outside lower front attachment unit; b--outside lower rear attachment unit; c--upper rear attachment unit.

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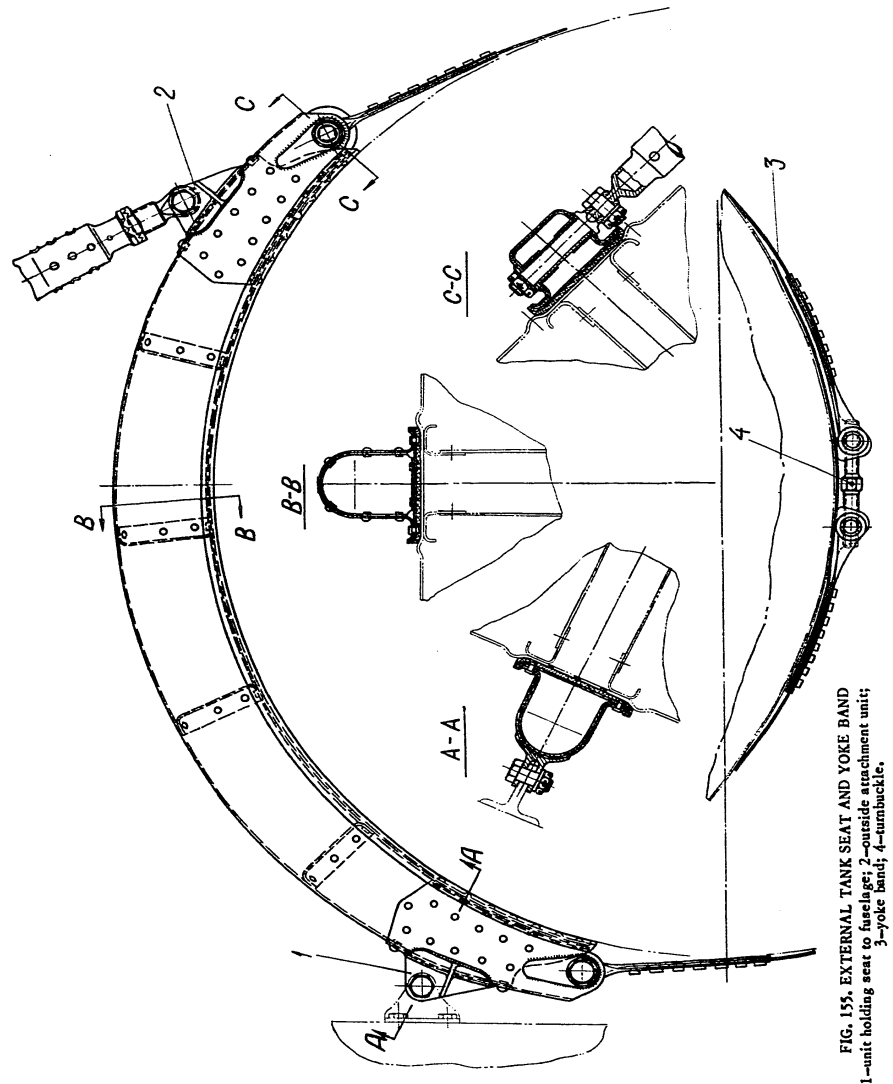


FIG. 155. EXTERNAL TANK SEAT AND YOKE BAND
1—unit holding seat to fuselage; 2—outside attachment unit;
3—yoke band; 4—turnbuckle.

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CONFIDENTIAL**ENGINE LUBRICATING OIL SYSTEM**

Each helicopter engine employs an independent lubricating oil system. If, therefore, one of the systems is damaged, the other one keeps supplying oil lubricant to its engine.

The lubricating oil system (Fig.156) consists of oil tank 6, oil cooler 2 (unit 857) with by-pass valve, pipelines, fittings, and two drain cocks 5 made as a single unit.

Oil from tank 1 (Fig.157) flows via pipeline 3 to the pump which carries it into the engine. After passing through the engine, oil drains into a sump, whence it is carried into a centrifuge, separating oil from air bubbles. De-aerated oil is delivered by the pump via pipeline 11 into oil cooler 10 and thence, into the oil tank.

The upper wall of the oil tank mounts two vent unions one of which is connected by a pipe to engine centrifugal breather 14, whereas the other communicates with free air through pipe 12 and a T-piece enclosed in oil drain pipe 9.

If necessary, oil from the delivery and scavenging pipelines is drained via two cocks 6 (Figs 158, 159, and 160) mounted in a common housing. Drain pipes 5, running from these cocks and designed also for breathing the engines, are laid over the walls inside the fuselage and are brought outboard on both fuselage lower sides. Should it become necessary, oil from the pipe, carrying oil into the engine, is drained through cock 5 (Fig.157), whereas oil from the oil tank is drained through cock 8.

The oil tank (Fig.161) is welded of sheet material AMH and has a capacity of 39 litres (during helicopter operation, the maximum amount of oil held in the tank is 23 litres, regardless of the oil contained in the engine lubricating oil systems).

The tank is provided with flanges 2 and 3 for attachment of vent unions; the upper cover of the tank carries filler 5 with cap 6, and a flange for mounting dipstick 1 (Fig.162). Fitted on the rear wall of the tank is union 4 (see Fig.161) serving for connection of the pipeline conveying oil from the oil cooler. Welded to the inner part of this union is a connection which directs the oil stream against the tank wall.

The tank bottom has flange 12 meant for installation of the drain cock and flange 11 designed for attachment of the union of the pipe carrying oil to the engine.

The tanks are arranged between the outer and inner skins of the engine air intakes and are attached with bands to the seats riveted to the inner wall of the air intake. The upper part of the engine air intake has a hatch through which installation and dismantling of the oil tank is accomplished.

All oil pipelines are made of piping AMT. The joints of the pipes running through the fire bulkhead, as well as the joints between the drain pipes and the engine employ nipples involving pipe expansion; each joint is secured by means of union nuts. The joints other than those mentioned above employ durite connections with clamping collars.

Oil temperature is measured by three-pointer indicator 3MK-3P; one of the indicator transmitters is installed in a special T-piece mounted on the pipeline carrying oil into the engine. Other transmitter 1 (Figs 163 and 164) located on the fire bulkhead serves for measuring oil pressure. The same bulkhead carries two more transmitters meant for measuring pressure of fuel flowing into the engine.

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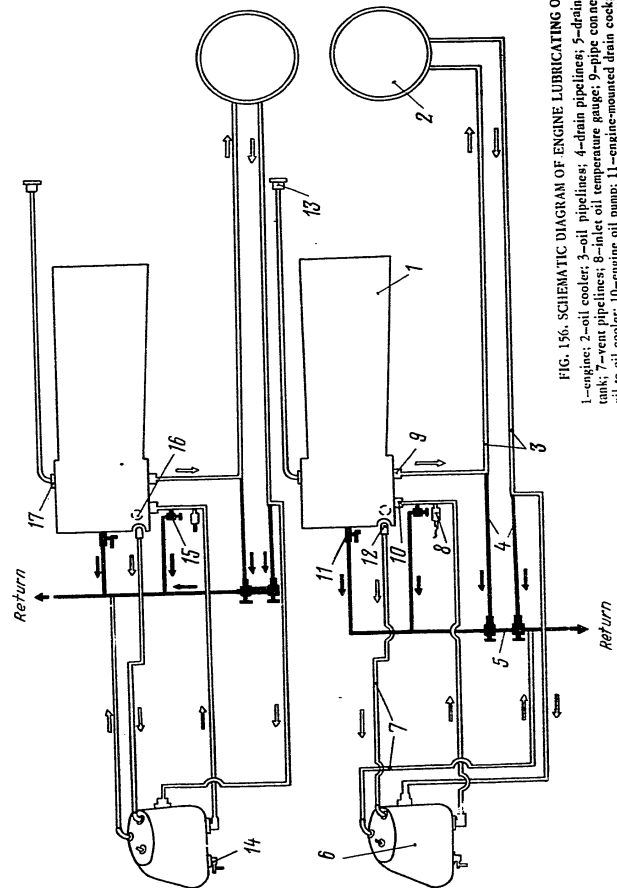
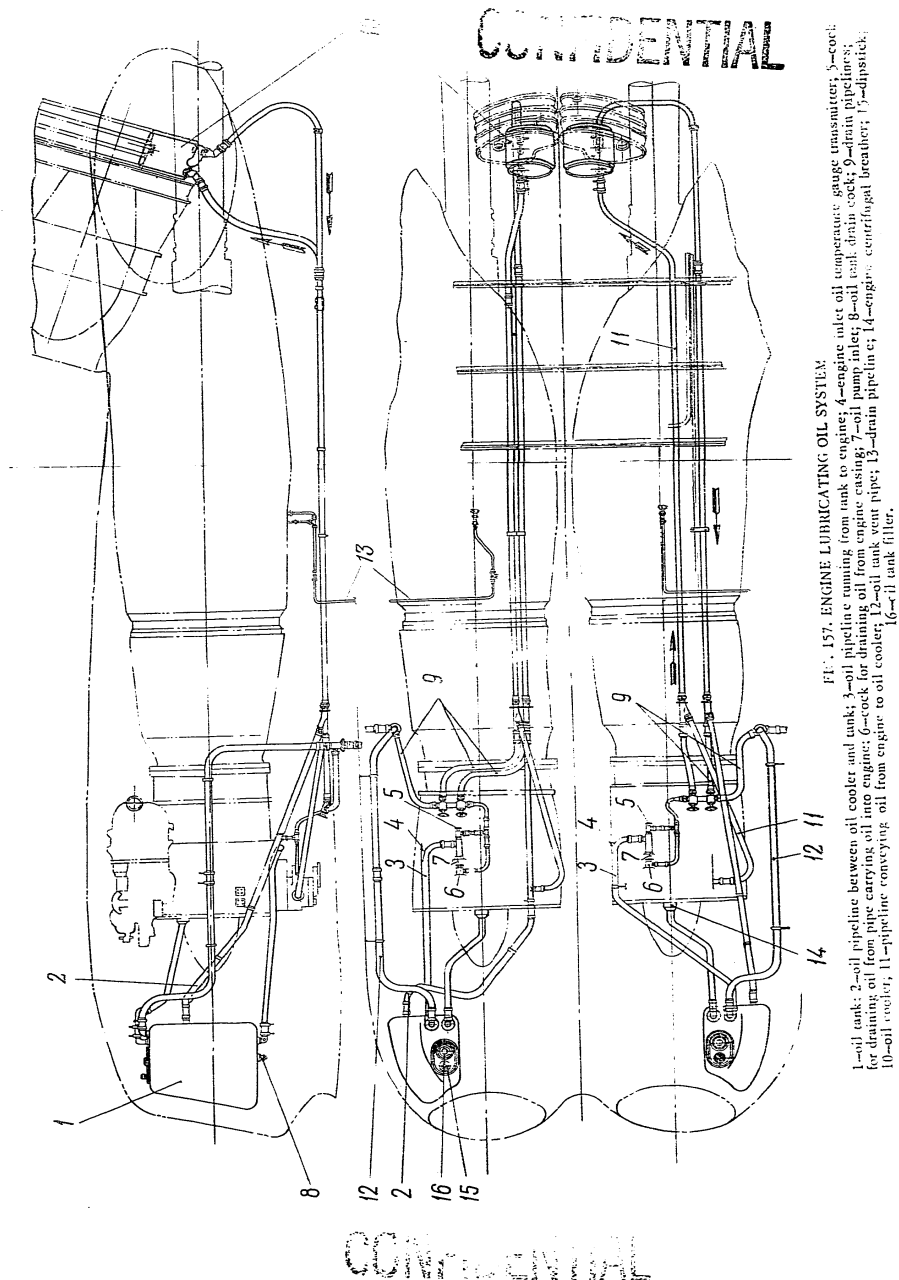


FIG. 156. SCHEMATIC DIAGRAM OF ENGINE LUBRICATING OIL SYSTEM
 1—engine; 2—oil cooler; 3—oil pipelines; 4—drain pipelines; 5—drain valve unit; 6—oil tank; 7—vent pipelines; 8—inlet oil test pressure gauge; 9—pipe connection for delivering oil to oil cooler; 10—engine oil pump; 11—engine-mounted drain cock; 12—engine centrifugal breather; 13—oil pressure transmitter; 14—cock for draining oil from oil tank; 15—cock for draining oil from pipeline; 16—filter; 17—deserator.

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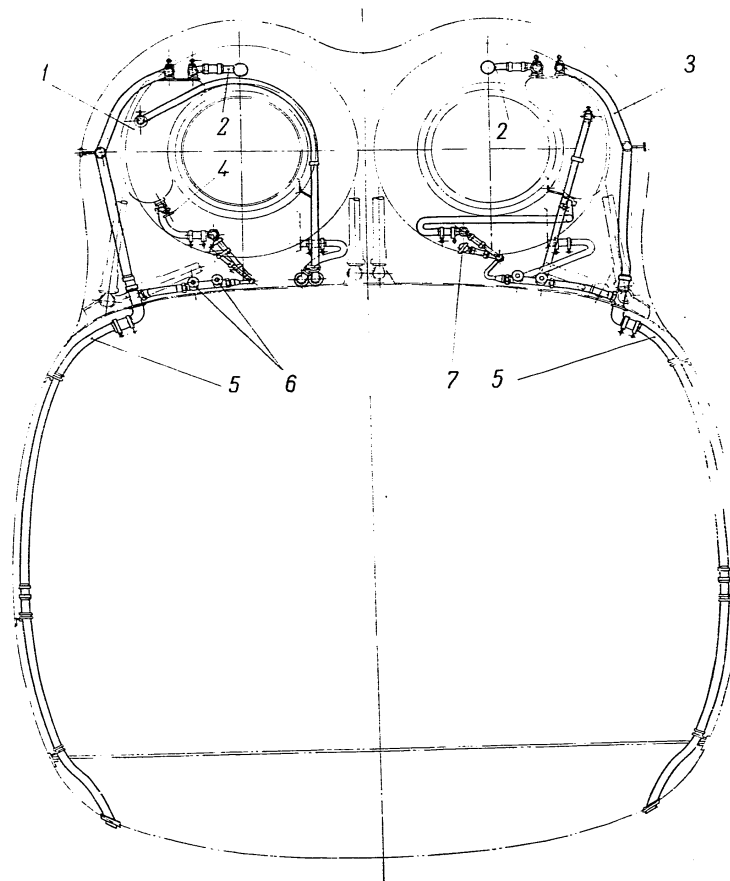


FIG. 158. ENGINE LUBRICATING OIL SYSTEM
(looking aft; oil tanks shown conventionally)

1-oil tank; 2-engine vent; 3-oil tank vent; 4-oil tank drain cock; 5-drain and vent pipes;
6-drain cocks; 7-engine casing drain cock.

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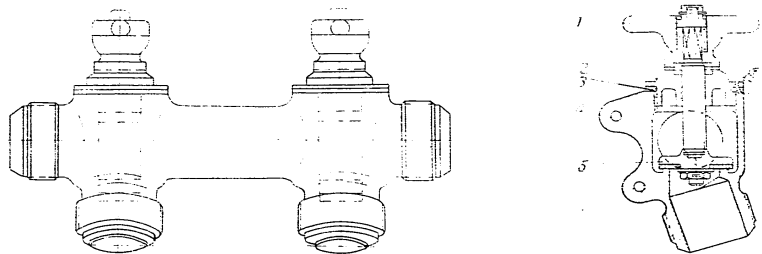


FIG. 159. OIL DRAIN COCKS
1-knob, 2-cover, 3-gasket, 4-body, 5-valve.

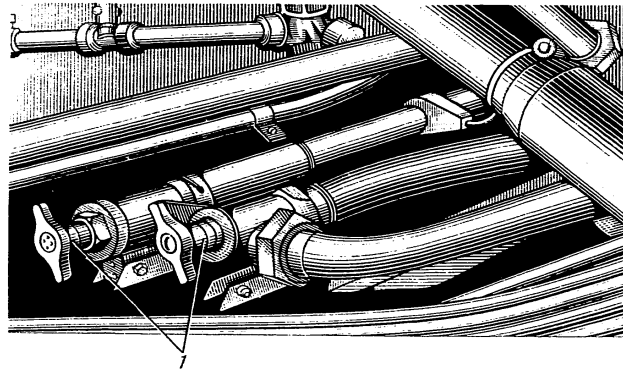


FIG. 160. OIL DRAIN COCK ARRANGEMENT
1-oil drain cocks.

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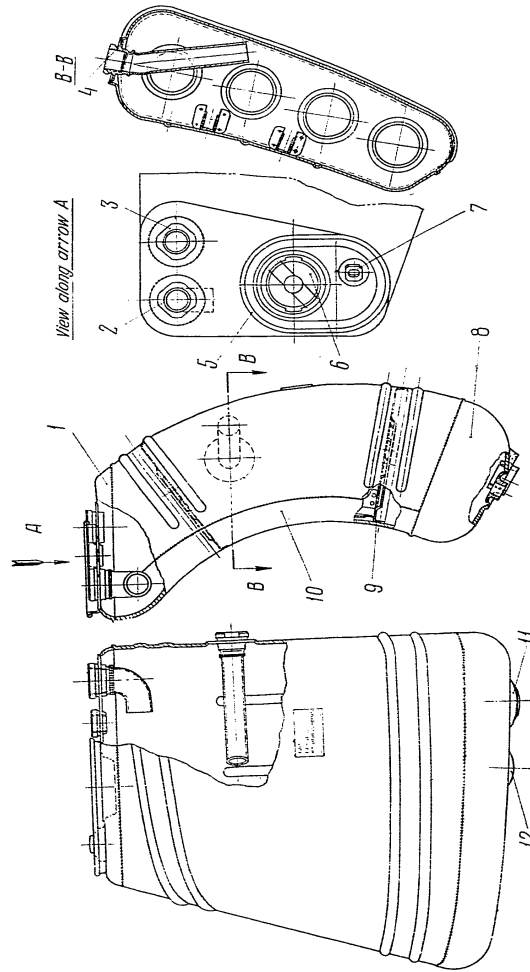


FIG. 161. OIL TANK
 1—upper wall; 2—flange for attachment of pipeline running from centrifugal pump; 3—flange for attachment of oil tank vent pipeline; 4—union for connection of pipeline led from oil cooler; 5—filler flange; 6—filler cover; 7—dipstick flange; 8—lower wall; 9—partition; 10—shells; 11—flange for connection of pipeline for oil outlet from tank; 12—flange for mounting drain cock.

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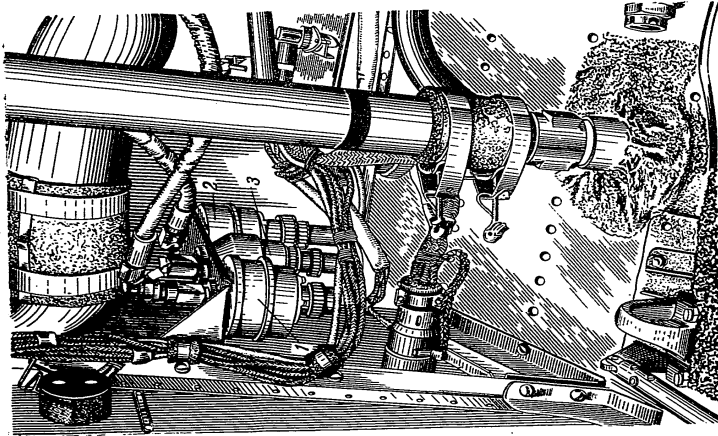


FIG. 163. OIL AND FUEL PRESSURE GAUGE TRANSMITTERS INSTALLED ON FIRE BULKHEAD (for starboard engine)
1-oil pressure transmitter WJ-8C; 2-fuel high-pressure transmitter WJ-100; 3-fuel pressure transmitter WJ-1

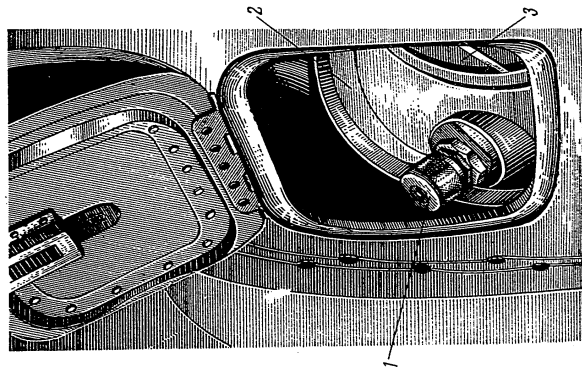


FIG. 162. DIPSTICK INSTALLED IN OIL TANK
1-dipstick; 2-tank upper wall; 3-filler cover,

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LUBRICATING OIL SYSTEM OF MAIN GEAR BOX AND FREE TURBINES

A schematic diagram of this lubricating oil system is presented in Fig.165.

The system comprises (Fig.166) two oil coolers 2 (unit 576), two by-pass valves 3 (unit 582-0), and pipelines 48 x 50 mm in diameter incorporated in the main gear box, and 20 x 22 mm in diameter, in the free turbines.

The two oil pumps installed on the main gear box and operating in parallel, are designed for scavenging oil from the gear box and delivering it via the by-pass valves into the upper connections of the oil coolers connected in parallel, too. Oil leaves the oil coolers by gravity through the lower connections, entering the main gear box casing.

The uppermost points of the pipes carrying oil into the oil coolers have auxiliary unions stopped with screw plugs. To accelerate draining of oil from the oil coolers, these plugs must be removed.

The by-pass valves (Fig.167) are intended for safeguarding the oil coolers against breakage when pressure increases due to oil thickening at low temperatures. As soon as pressure exceeds 4 kg/sq.cm, the spring is pressed off, and the major portion of oil is returned into the main gear box casing, by-passing the oil coolers.

Scavenging pump 1 (Fig.166) mounted on the casing of each free turbine feeds oil via chip-detecting filters 9 into the main gear box casing whence oil is carried by special pumps enclosed inside the gear box to the shaft and free turbine bearings (via pipes led through the transmission casing).

The chip-detecting filter (Fig.168) is designed for generating electric signals in the event chips are contained in the oil. Along the pipeline and connection 12 oil flows into housing 3 and, after passing gauze filter 2, is drained into the main gear box casing through a large hole in the filter housing.

As soon as chips appear in the oil, the filter resistance increases with resultant increase in oil pressure, which causes valve 6 to open. The chips contained in the oil get into contact device 10 and close the circuit, making a red light flash up on the flight engineer's instrument panel.

Through the breathers of the free turbines oil is discharged together with air as fine drops or emulsion trapped by tank 7 (Fig.166) and directed through a pipe into the gear box casing.

Oil level in the gear box is measured by dipsticks installed in the caps of the main gear box fillers.

Oil temperature is checked by an electric temperature gauge whose transmitter is mounted on the main gear box casing.

COOLING OF UNITS

The unit cooling (airing) system is illustrated in Fig.169.

The power plant units are cooled by air delivered by cooling fan 5 coupled to the main gear box by means of a cardan shaft.

Air is driven by the fan (Fig.170) to the following units: engine oil coolers, oil coolers of the main gear box, hydraulic pumps, D.C. starter generators, A.C. generators, engine exhaust pipes, and the air compressor mounted on the port-side engine.

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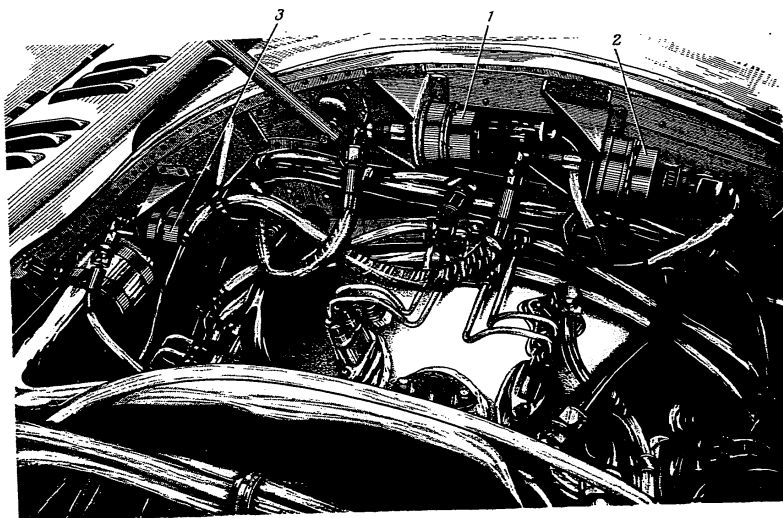


FIG. 164. OIL AND FUEL PRESSURE GAUGE TRANSMITTERS INSTALLED ON FIRE
BULKHEAD
(for port-side engine)
1-oil pressure gauge ИД-8С; 2-fuel high-pressure transmitter ИД-100; 3-fuel pressure trans-
mitter ИДТ-4.

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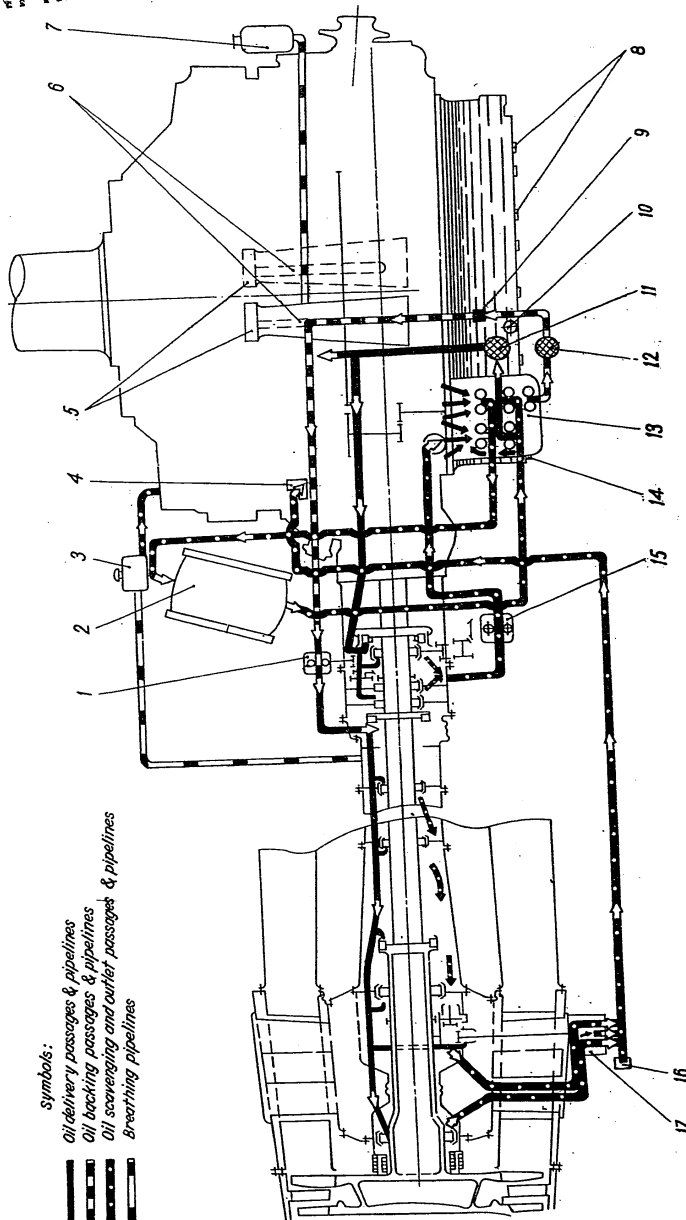


FIG. 165. SCHEMATIC DIAGRAM OF THE MAIN GEAR BOX AND FREE TURBINE LUBRICATING OIL SYSTEM

1-transmission oil pump; 2-oil cooler; 3-breather tank of free turbine transmission; 4-chip-detecting filter; 5-fillers; 6-dipsticks; 7-gear box breather tank; 8-magnetic plugs (9 pieces); 9-backing system safety valves; 10-check for draining oil from gear box; 11-oil filter MFC-19-11; 12-oil filter MFC-19-11; 13-main oil filter MFC-19-11; 14-plug for draining oil from transmission and gear box power equalizing mechanism housings; 15-pump MHP-23; 16-drain plug; 17-oil scavenging pump MHP-231.

1-transmission oil pump; 2-oil cooler; 3-breather tank of free turbine transmission; 4-chip-detecting filter; 5-fillers; 6-dipsticks; 7-gear box breather tank; 8-magnetic plugs (9 pieces); 9-backing system safety valves; 10-check for draining oil from gear box; 11-oil filter MFC-19-11; 12-oil filter MFC-19-11; 13-main oil filter MFC-19-11; 14-plug for draining oil from transmission and gear box power equalizing mechanism housings; 15-pump MHP-23; 16-drain plug; 17-oil scavenging pump MHP-231.

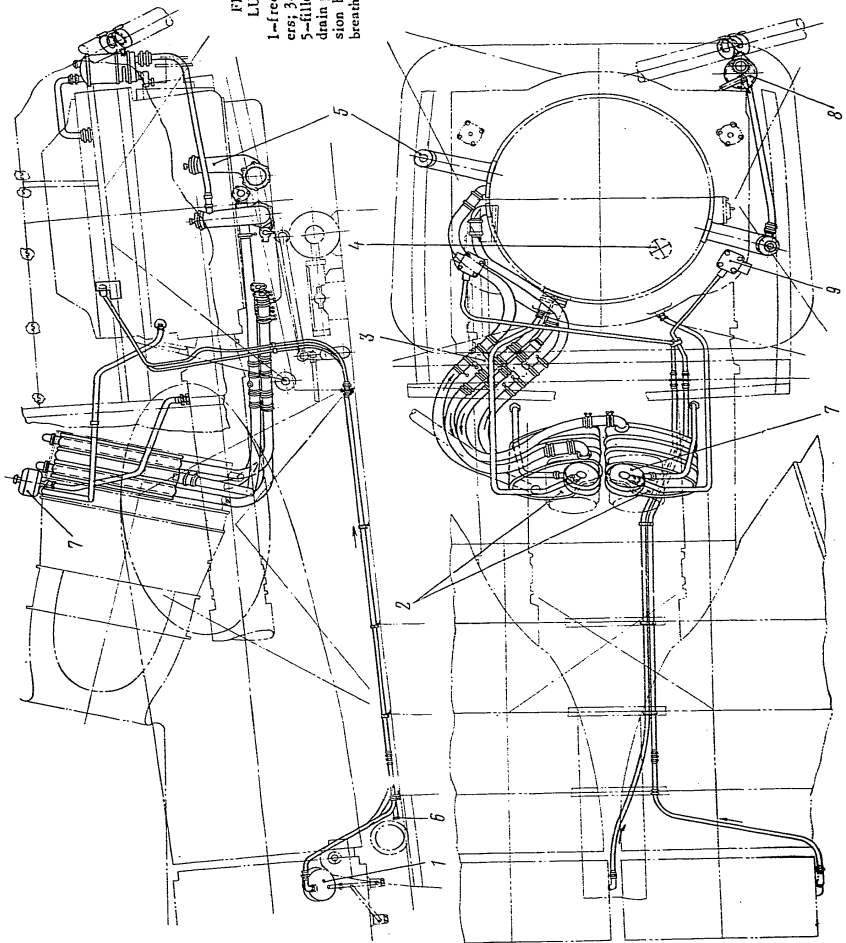
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FIG. 166. MAIN GEAR BOX
LUBRICATING OIL SYSTEM
1-free turbine oil pump; 2-oil cooler;
3-bypass valves; 4-drain cock;
5-filters; 6-free turbine pipeline oil
drain plug; 7-free turbine transmis-
sion breather tank; 8-gear box
breather tank; 9-chip-detection fil-
ter. 90-23.



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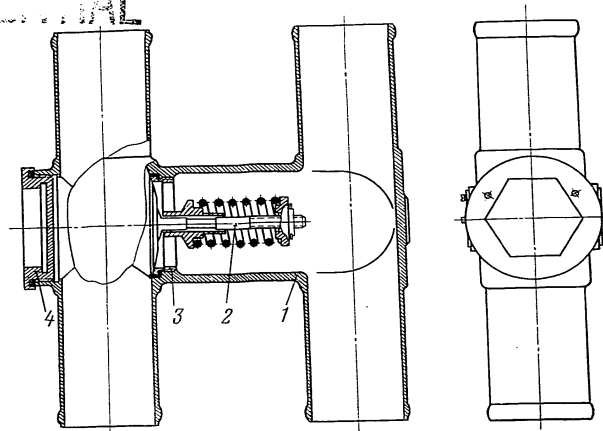


FIG. 167. OIL BY-PASS VALVE
1-housing; 2-spring-loaded valve; 3-valve seat; 4-cover.

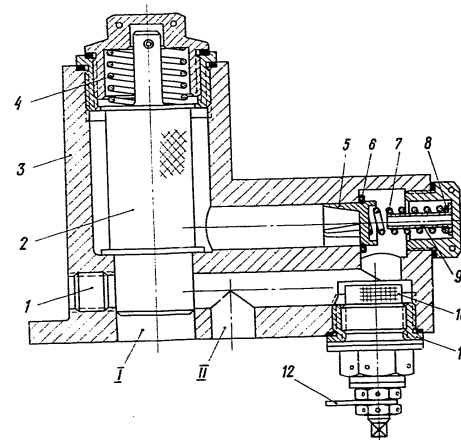


FIG. 168. CONSTRUCTION OF CHIP-DETECTING FILTER $\Phi C-23$
I-hole for draining clean oil into main gear box casing; II-hole for draining oil into gear box casing in case filter is clogged
1-plug; 2-gauze filter; 3-housing; 4-filter spring; 5-valve; 6-gasket; 7-valve spring; 8-washer; 9-guiding sleeve; 10-contact device; 11-bush; 12-electric wire contact plate.

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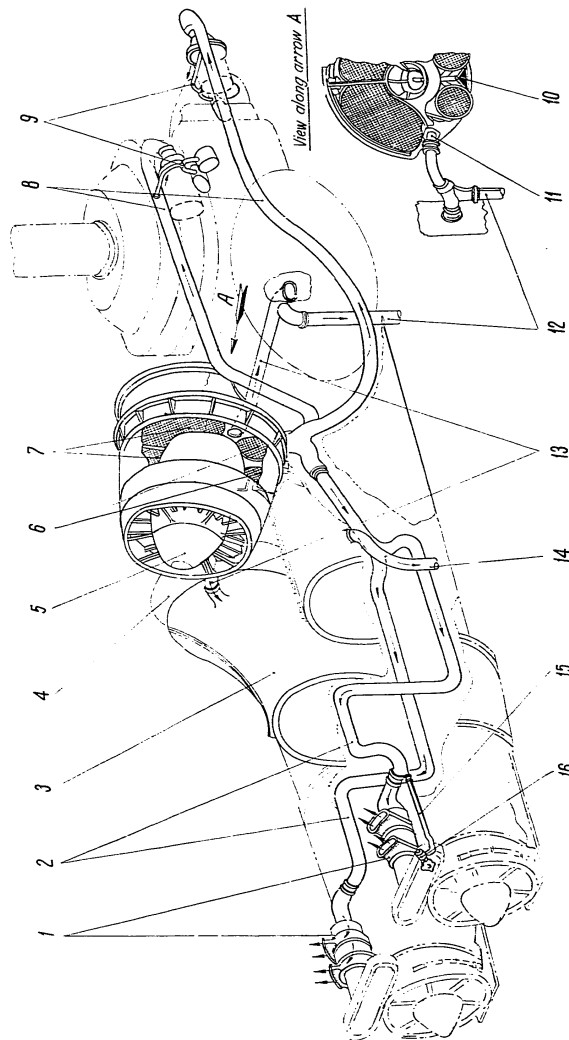
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FIG. 169, COOLING SYSTEM

1 - shrouds with pipe connections for cooling starter generators; 2 - pipes for cooling air supply to starter generators; 3 - exhaust pipe shroud; 4 - exhaust pipe; 5 - cooling fan; 6 - engine oil coolers; 7 - gear box oil coolers; 8 - pipes for cooling air supply to A.C. generators; 9 - pipe connections for cooling air supply to hydraulic pumps; 10 - central hole; 11 - pipe connection for cooling air delivery to exhaust pipe; 12 - pipe supplying air for cabin ventilation; 13 - pipes for supplying air under exhaust pipe shrouds; 14 - pipe for directing air into cabin heating system; 15 - pipe for air supply to compressor AK-501; 16 - compressor cooling bonnet.

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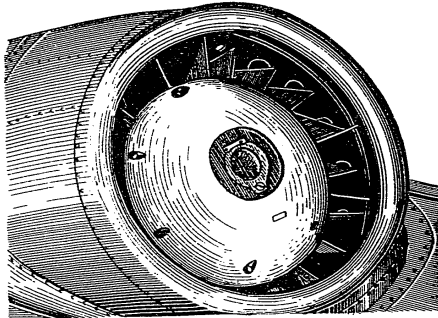


FIG. 170. COOLING FAN PROTECTED WITH COWL
(front view)

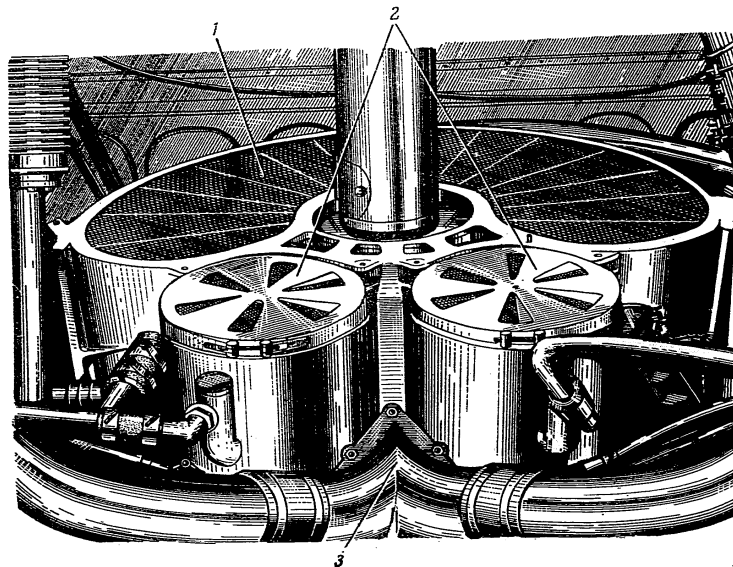


FIG. 171. OIL COOLER ASSEMBLY
(as viewed through cargo compartment hatch)
1—gear box oil coolers; 2—engine oil coolers; 3—spider connection.

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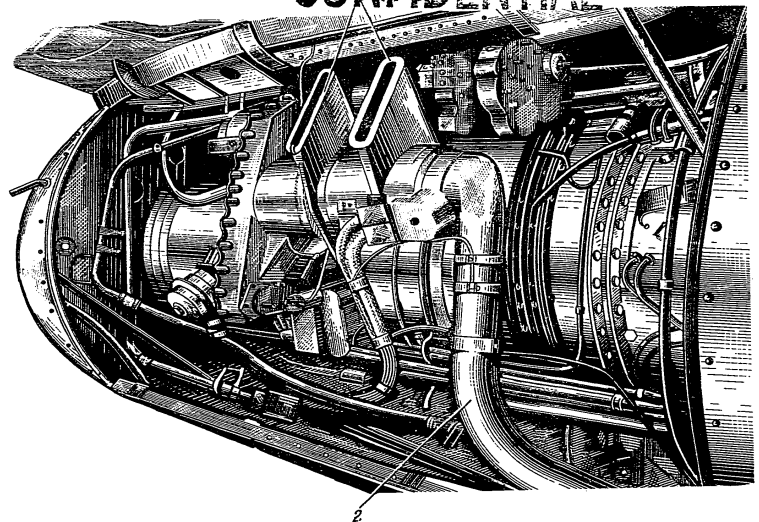


FIG. 172. PIPELINES SUPPLYING COOLING AIR TO PORT-SIDE ENGINE D.C. GENERATOR
1—pipe connections for outlet of cooling air; 2—pipe supplying cooling air to generator.

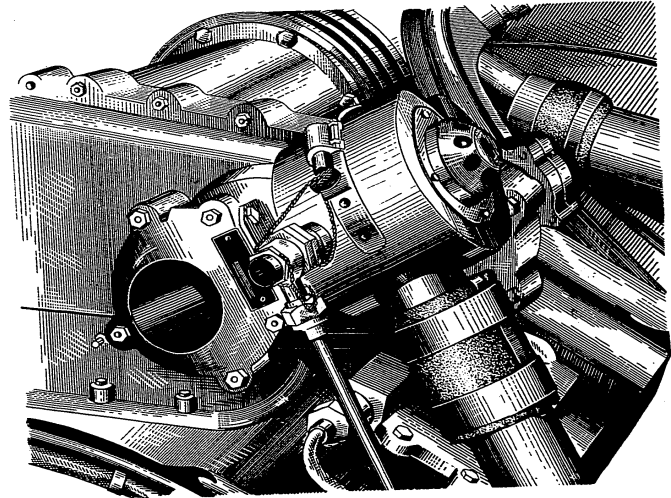


FIG. 173. JOINT ON PIPE SUPPLYING COOLING AIR TO COMPRESSORS.

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The magnesium alloy saddle designed for attachment of the oil coolers (Fig.171) is provided with three holes. From central triangular hole 10 (see Fig.169) air is supplied into spider connection 3 (see Fig.171) and further flows via a 113-mm diameter pipe into a T-piece branching into 82-mm diameter pipes. Along these pipes cool air is brought to the D.C. starter generator bodies (see Fig.169) to cool them and escape overboard through the respective pipe connections secured to the generators with clamping collars (Fig.172).

The hydraulic pumps are cooled by air supplied along pipe connections 9⁽²⁾ (see Fig.169).

Air for cooling compressor AK-50T is bled from starter generator cooling pipe 2, and then is sent along pipe 15, 35 mm in diameter, under compressor bonnet 16 (Fig.173); after cooling the compressor, the air is discharged under the cowl.

Through the two side holes (82 mm in diameter) provided in the saddle and two pipe connections 11 (see Fig.169), the fan delivers air under shrouds 3 for cooling exhaust pipes 4, the air for ventilation of the cargo compartment being fed through pipelines.

Shrouds 3 are manufactured from stainless steel 0.8 mm thick. The inner surfaces of the shrouds carry riveted profiles making up spiral ducts directing the air stream round the exhaust pipe. The heated air, issuing from the front pipe connections of the shrouds, enters the T-piece furnished with slewing shutters causing the hot air to flow either into the air-to-air cooler or beyond the cowl.

Pipes 14, bleeding air from the shrouds into the cabin heating system, are fabricated from sheet material AMI-M (0.8 mm thick) and are heat-insulated with band JAC-5.

The joints of the pipes supplying cool air employ flexible rubber couplings, and those of the pipes feeding hot air, clamping collars with copper-asbestos gaskets.

All the pipes delivering air for cooling of the units are painted black.

HEAT-INSULATING SCREENS

The engine parts exposed to the most elevated temperatures are insulated from the fuselage structure by means of an easy-detachable screen formed by a trough encircling the bottom section of the turbine housing.

The screen of each engine is comprised of panels longitudinally interconnected with the aid of coupling angle bars held by screws and self-locking nuts. The screen is fabricated from sheet duralumin 116A-T NO.8 and edged with angle bars. Riveted to the lower part of the screen by means of transverse duralumin strips is insulating asbestos fabric KB-3. The front part of the screen is attached with screws and self-locking nuts to four H-shaped sections riveted to the transverse fire bulkhead that is located between frames Nos 5 and 6 in the central part of the fuselage. The rear part of the screen is attached in the vicinity of frames Nos 7 and 8 by means of one welded bracket to the fuselage ceiling, and by two other brackets, to the middle and side supports of the engine.

Installed between the transverse fire bulkhead and frame No.10 in the central part of the fuselage is an additional panel designed for protection of the ceiling panel and the control system links in the event of fire. The protective panel consists of eight individual shields, four of which are arranged at the starboard

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between stringers Nos 2 and 4, and the other four, at the port side, between stringers Nos 3 and 5. The shields are manufactured from titanium alloy BTI-I M0.4 and are provided with flanges by means of which they are secured to the ceiling panel with screws and self-locking nuts.

The lower surfaces of the shields carry insulating asbestos fabric MMTIV I646-53 M2.5 attached with rivets and transverse steel strips.

The shield joints are located at the frame flanges and are protected on top by box sections of alloy BTI-I M0.4 held to the shields by rivets.

FIRE-FIGHTING SYSTEM

The helicopter is provided with a fire-fighting system (Figs 174 and 175) designed for extinguishing fire, should it develop in the vicinity of the engines, the main gear box, or in the fuel tank compartments. The system includes eight fire extinguishers 6, type OC-8M, electromagnetic valve assembly 7, fire alarm system CCH-2A incorporating fire detectors 4, servo unit EM-II-AV, as well as pipelines and atomizers 3.

The fire-extinguishers are mounted in the fan compartment and are divided according to the sequence of operation into two groups each containing four eight-litre capacity cylinders. The first group of cylinders is started automatically, the second group being put in operation by the flight engineer through depressing the respective button on the control panel.

Fire-extinguishers OC-8M, each amounting to 8 litres in capacity, are charged with fire-extinguishing compound "3.5" containing a mixture of 95.8 per cent ethyl bromide and 4.2 per cent chloroform ($4^{+0.1}$ kg) and dehydrated carbon oxide ($1.7^{+0.2}$ kg). Besides, the fire-extinguisher is charged with air compressed to 85 ± 5 kg/sq.cm.

The fire-extinguisher consists of cylinder APX-8, discharge bonnet I3CM, a pressure gauge, and a syphon tube. The discharge bonnet encloses an explosive charge and a safety diaphragm ruptured by a pressure of 200 kg/sq.cm which may reach such a value due to an ambient air temperature increase over $+90^{\circ}\text{C}$.

As soon as fire occurs, the fire detector will operate thereby sending an electric pulse via the servo unit to the electromagnetic valve assembly, as well as to light panel FIRE (HOXAP) arranged on the pilots' instrument panel, and to the warning light on the flight engineer's instrument panel, thus indicating fire in the respective compartment.

When the valve opens, an electric pulse is applied via the respective relay to the explosive charges of the first group fire extinguishers. Simultaneously, light panel VALVE OPEN (KPAH OTKPMT) flashes up on the flight engineer's instrument panel. Operation of the explosive charges is also indicated by four warning lights.

The valves are opened through action of the explosive charges, as a result of which the fire-extinguishing mixtures contained in the fire extinguishers are discharged through the pipeline atomizers into the fire zone under the carbon oxide and air pressure.

After the fire ceases and the temperature drops down, the fire alarm system is set in the initial position (the light panels and warning lights go out except for the light panel indicating fire in the engine compartment).

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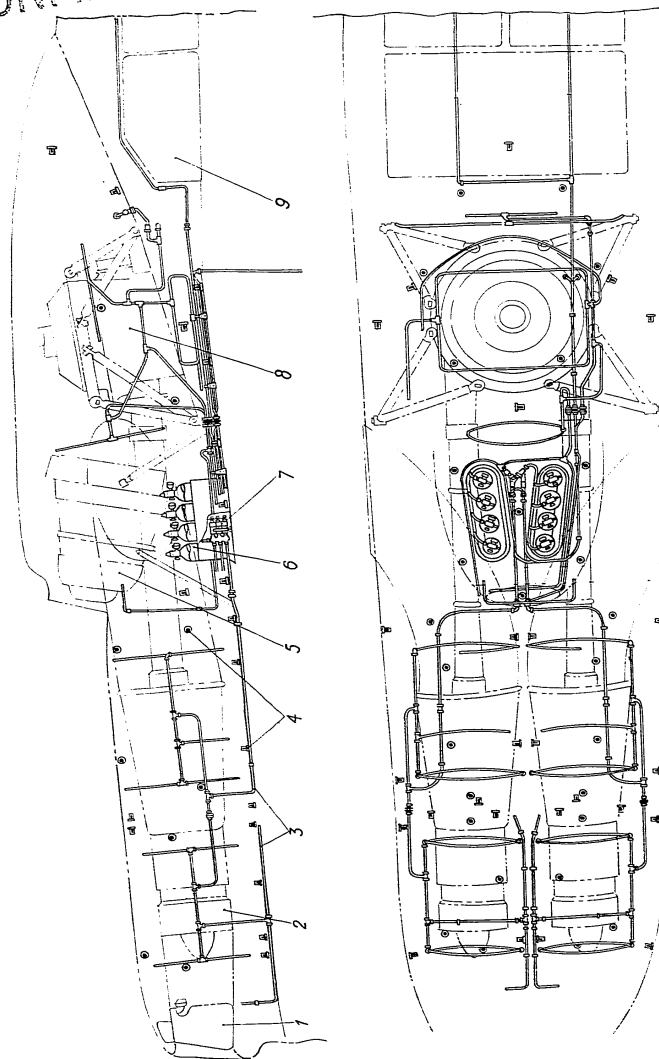


FIG. 174. LAY-OUT DIAGRAM OF SYSTEM FOR EXTINGUISHING FIRE IN ENGINE AND GEAR BOX COMPARTMENTS
1-oil tank; 2-engine; 3-pipelines with atomizers in engine compartment; 4-fire detectors; 5-cooling fan; 6-fire extinguishers; 7-electro-magnetic fire-fighting valve assembly; 8-main gear box; 9-upper fuel tank No.11.

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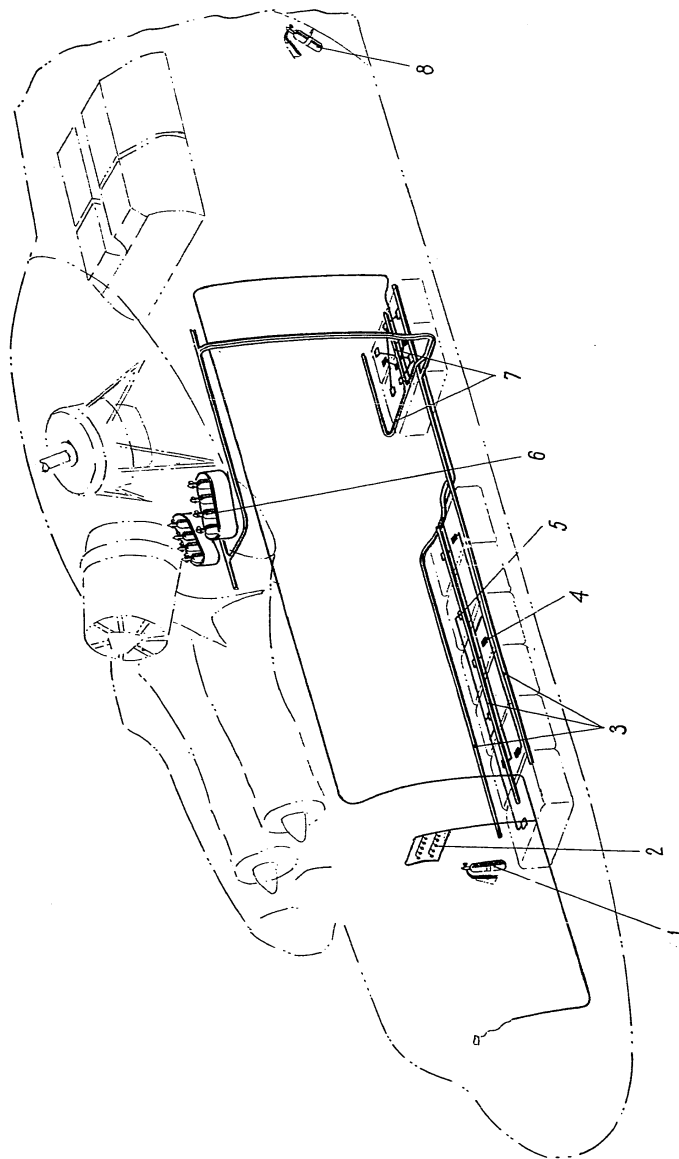


FIG. 175. LAY-OUT DIAGRAM OF SYSTEM FOR EXTINGUISHING FIRE IN LOWER FUEL TANK COMPARTMENT
 1, 8 - portable fire extinguishers OV-2; 2 - flight engineer's fire-fighting system control panel; 3 - pipelines and atomizers of tank groups I and II; 4 - fire detector Δ [IC-1A]; 5 - fire detector Δ [IC-1A]; 6 - fire extinguishers; 7 - pipelines and atomizers of tank group III.

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If the fire fails to be extinguished by the group of cylinders functioning automatically, the other group of fire extinguishers may be put in operation by depressing the respective button.

The atomizers installed in the engine and gear box compartments are circular or otherwise shaped steel tubes with 0.8-mm dia. holes spaced at 40 to 70 mm along the perimeter.

The fuel tank compartments employ atomizers made in the form of straight tubes provided with similar holes (Fig. 175).

The fire detectors are arranged under the engine and gear box cowl and in the fuel tank containers. The number and arrangement of the detectors will be seen by reference to Figs 174 and 175.

Charging of the fire extinguishers, their storage and checking should be accomplished in accordance with special instructions.

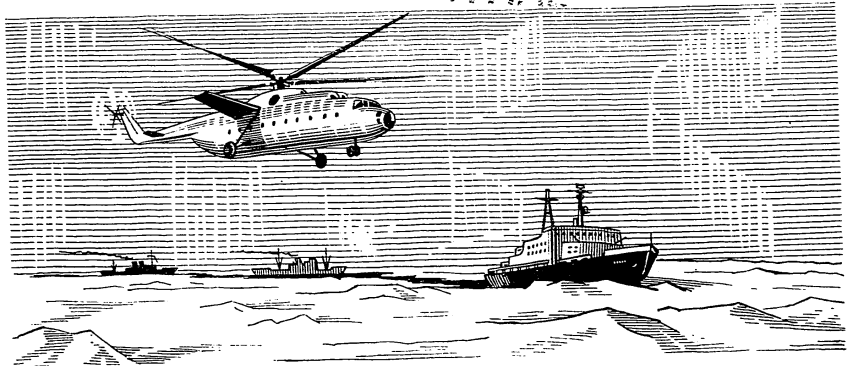
Apart from the fire-fighting system described above, two portable fire extinguishers QV-2V^{and one on-5} are installed at frame No.1 in the cargo compartment and on the cargo compartment left-hand door panel.

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Chapter V

TRANSMISSION AND COOLING FAN

The purpose of the transmission is to convey the torque and the change in the RPM from the two turbo-rotor engines to the main and tail rotors, fan, and accessories mounted on the main gear box.

The transmission (Fig.176) comprises the following assemblies: main gear box, intermediate gear box, tail gear box, tail shafts, main rotor brake, and fan driving system.

1. TAIL GEAR BOX

The tail gear box is designed for rotating the tail rotor at a lower speed as compared with that of the main rotor.

Basic Specifications

Gear box ratio	$i = \frac{25}{74} = 0.338$
Direction of rotation:	
(a) driving shaft	counterclockwise (looking from tail boom)
(b) driven shaft (tail rotor shaft)	clockwise (looking from tail rotor)
Rated speed of rotation:	
(a) driving shaft	2006 r.p.m.
(b) driven shaft	678 r.p.m.

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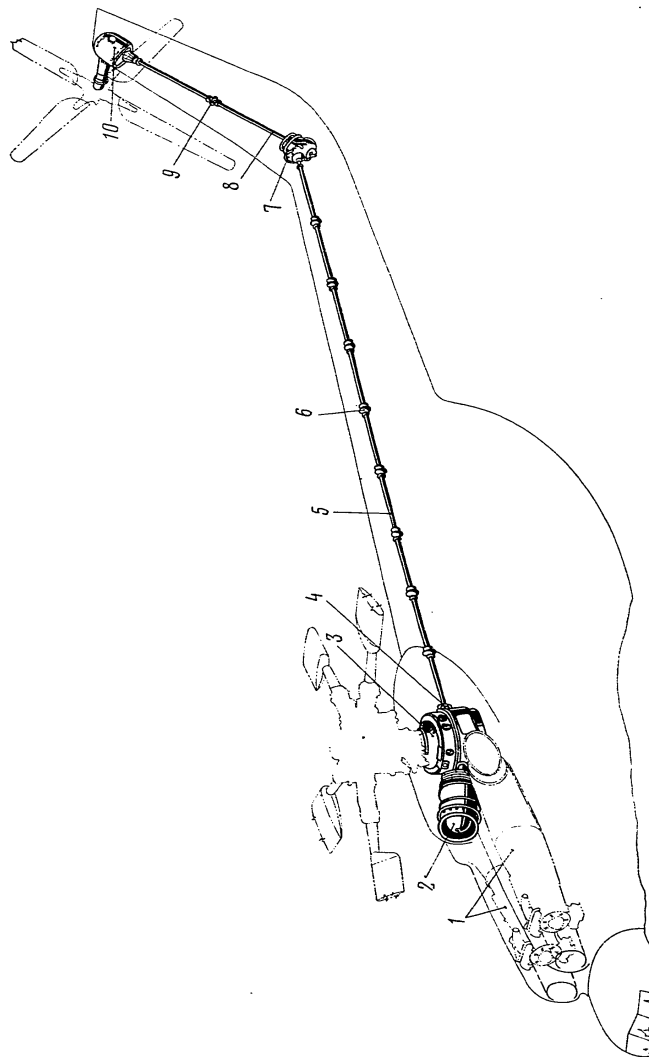


FIG. 176. HELICOPTER TRANSMISSION
1—engines; 2—fan; 3—main gear box; 4—transmission brake; 5—tail shaft; 6—intermediate support of tail shaft; 7—intermediate gear box; 8—shaft end portion; 9—shaft end portion intermediate support; 10—tail gear box.

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Lubrication

Lubrication method used	main system - forced lubrication; duplicating system (in case of main system failure) - splash lubrication
Type and quantity of oil pumps	one gear pump comprising only delivery stage
Oils used:	
(a) in summer time	hypoid oil, State Standard IOCT 4003-53
(b) in winter time	mixture of 2/3 hypoid oil (by volume), State Standard IOCT 4003-53, and 1/3 AMT-IO oil, State Standard IOCT 6794-53
Oil pressure during gear box service	at least 0.5 kg/sq.cm at idle rating and at least 2 kg/sq.cm at other ratings
Oil temperature in gear box	115°C-125°C max
Amount of oil in gear box	26 litres
Weight of gear box (when dry)	260 kg

CONSTRUCTION OF TAIL GEAR BOX

The tail gear box (Fig.177) consists of one pair of bevel gears mounted in antifriction bearings inside the gear box case.

The gear box has two outputs: one for connection with the tail shaft and the other for driving the tail rotor.

The gear box case is cast of magnesium alloy and comprises case proper (Ref. No.20) and filler 13.

Case 20 is provided with a streamlined flange (view along arrow T) held to the flange of the helicopter pylon by thirteen bolts. The case and the fairing riveted to it form an aerodynamically streamlined profile.

Connected to flange 41 of driving shaft 36 is the helicopter transmission tail shaft. To compensate for the angular misalignment, flange 41 is connected to driving shaft 36 with the aid of short barrel-shaped splines sealed with rubber rings 40. Driving shaft 36 is carried in radial ball bearing 39 located in gear box oil sump body 38.

To prevent oil from getting inside bearing 39, the cavity of the bearing is separated from that of the oil sump by oil sealing sleeve 37 provided with oil scraping thread and rubber collar 35.

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Driving shaft 36 transmits the torque to shaft 34 of driving gear 30 with the help of outer splines. Shaft 34, along with the driving gear splined to it, rotates in three bearings: two roller bearings 32 and 28 and ball bearing 31. The roller bearings are intended to take up the radial stresses, whereas the ball bearing coupled with roller bearing 32 takes up only axial loads since it is mounted in bearing sleeve 33 with a clearance measured off its outer circumference. Sleeve 33 of the driving gear bearings is secured in the gear box case with the aid of studs.

Driving bevel gear 30 has twenty-five case-hardened teeth and serves to transmit the torque to driven gear 44 which has seventy-four teeth and to driven shaft 5 through the splines of hub 45. The gear teeth are made helical to reduce the noise, increase their service life, and ensure smooth meshing.

Hub 45 along with the driven gear held to it by sixteen bolts is carried in three bearings: two roller bearings 19 and 16 and one ball bearing 17.

Just as in the case of the driving gear, the roller bearings take up the radial stresses, whereas the ball bearing, coupled with roller bearing 16, receives only axial loads, being mounted in filler sleeve 15 with a clearance measured off the outer circumference.

The gear mesh is adjusted (permissible surface contact and tooth side clearance are ensured) by selecting required adjusting rings 43 and 46.

Driven shaft 5 is installed in the gear box case filler and runs in two coupled bearings. Roller bearing 12 takes up radial stresses, and ball bearing 11, axial loads.

The oil cavity of the driven shaft bearings is provided with a two-stage labyrinth seal formed by the rectangular thread machined on the inner cylindrical surface of filler cover 10 and the outer surface of distance sleeve 8. The oil dripping through the labyrinth seal first stage is drained via holes drilled in cover 10 and the case filler (see section through oil drain line, Fig.177).

Arranged in the inner groove of cover 10 is felt gland 9 preventing penetration of dust and dirt into the cavity of the bearings. Cover 10 is fitted with a flange to which the slip ring assembly of the tail rotor de-icer is attached. To avoid a rarefaction in the inter-labyrinth space, the latter communicates with the inner cavity of the gear box case through a duct.

The splined end of the driven shaft is brought out of the gear box case to mount the tail rotor hub. Pressed into the driven shaft is bushing 6 splined to slide 7 and locked against turning by pin 4. The bushing is protected against penetration of dust and dirt by rubber boot 3.

Slide 7 rotates together with the driven shaft and is capable of translational motion in splined bushing 6. The slide end protruding beyond the driven shaft is provided with splines on its outer surface which serve to connect the slide to the tail rotor spider; the purpose of the latter is to change the blade setting angle.

The slide and the tail rotor spider coupled to it are displaced in the axial direction by means of tail gear box rod 2, one end of which is connected with slide 7 through two-row ball bearing 1, and the other, with nut 26 screwed onto it. The nut is, in turn, bolted to sprocket 27 running in two ball bearings 22 and 23 inside sleeve 21 of the rod which is secured with studs in the gear box case. The bearing cavity is sealed by reinforced rubber collar 24.

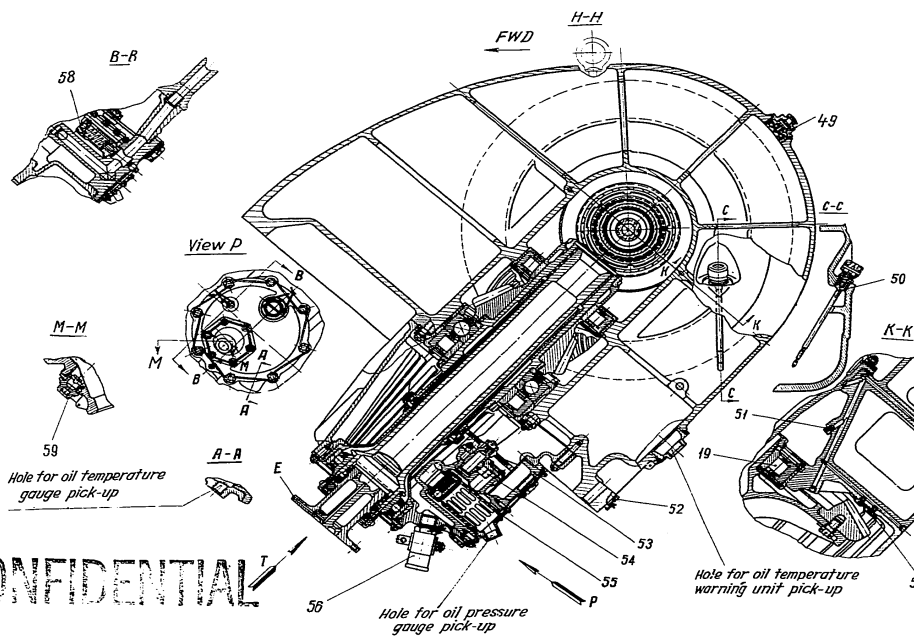
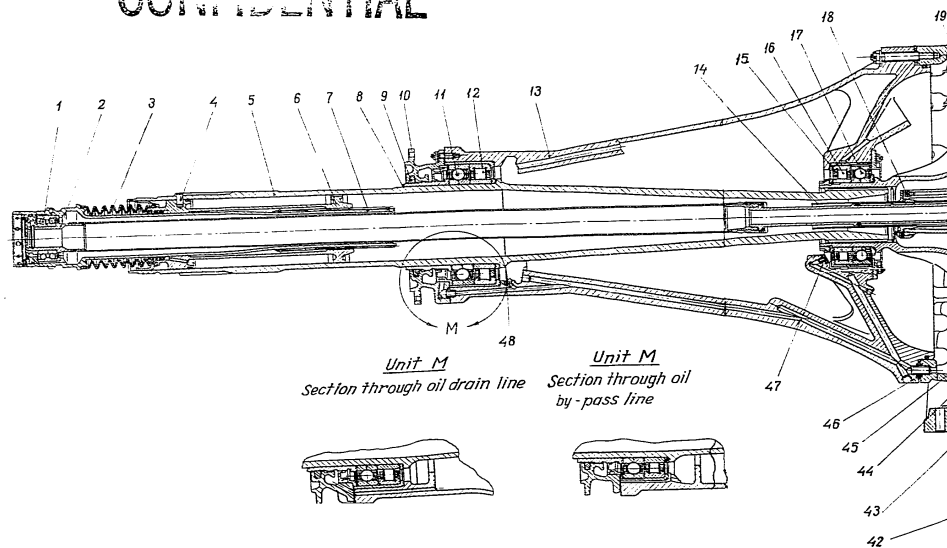
Rotation of the sprocket, connected to the helicopter foot control system through a bushed chain, causes rod 2 to axially move over a distance of 115 mm.

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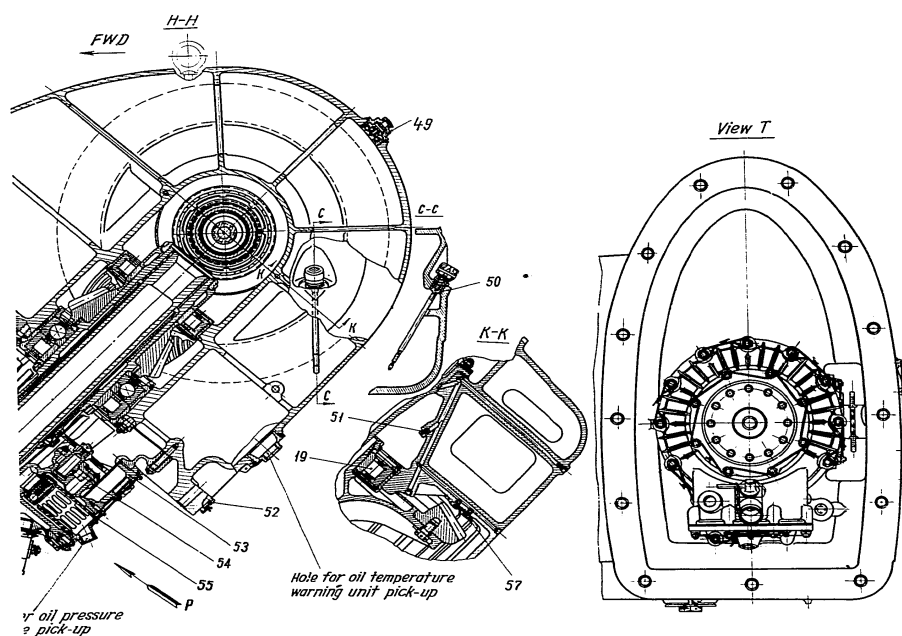
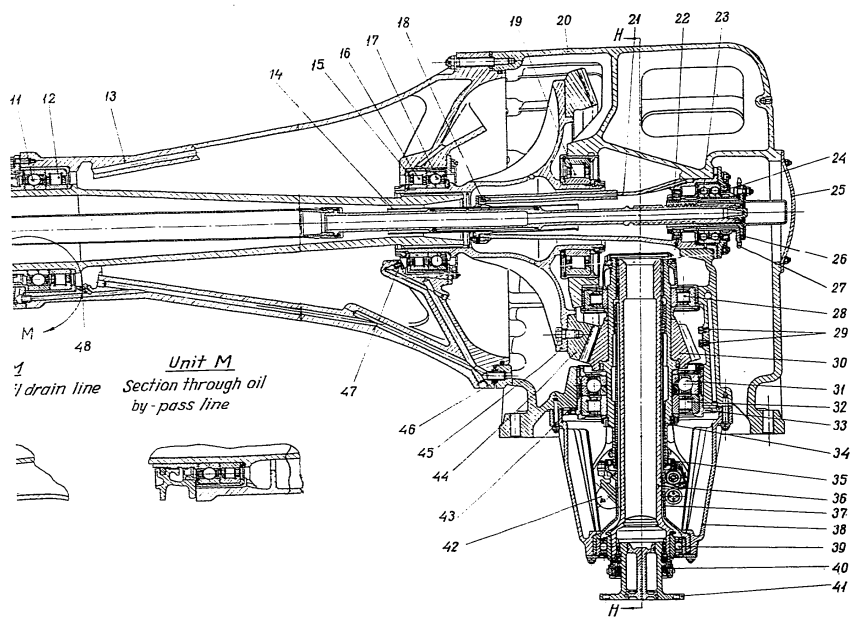
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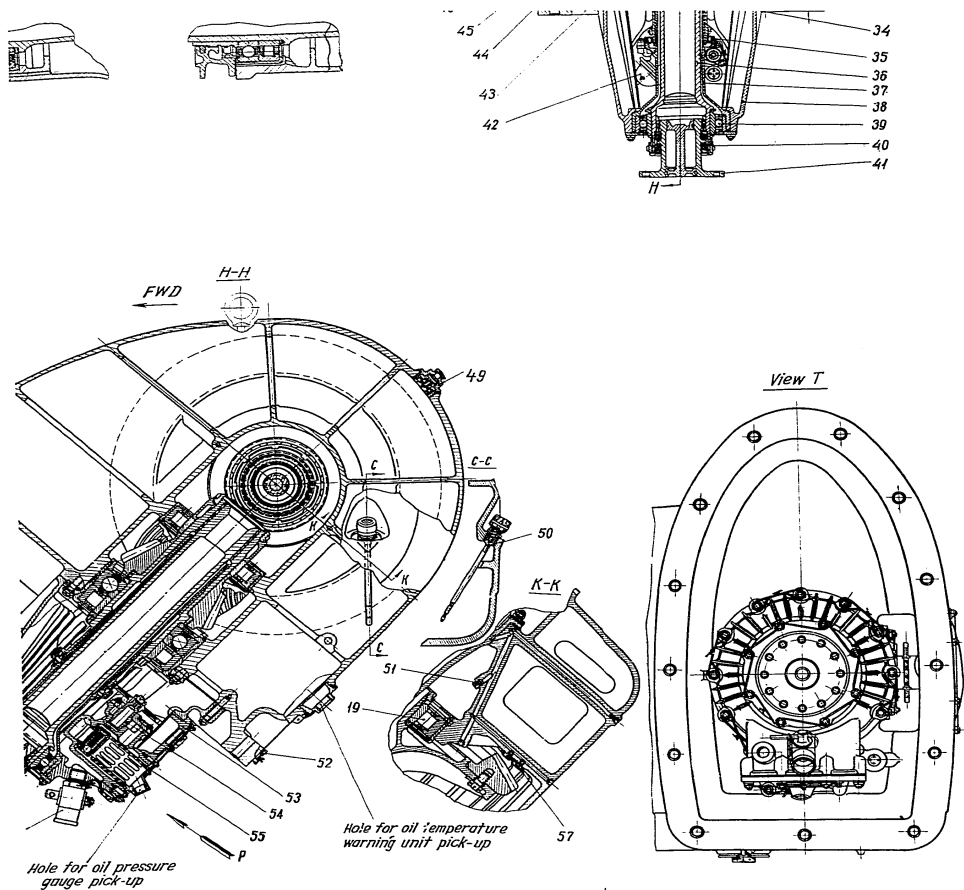


FIG. 177. TAIL GEAR BOX (24)

1-pin; 5-driven shaft; 6-splined
 9-packing gland of filler cover;
 radial roller bearing; 13-filter;
 5-radial roller bearing;
 aring; 20-tail gear box case;
 l-thrust ball bearing; 24-rein-
 1 sprocket; 28-radial roller
 rust ball bearing; 32-radial

roller bearing; 33-sleeve for driving gear bearings; 34-driving gear shaft; 35-rubber collar;
 36-driving shaft; 37-oil sealing sleeve of driving shaft; 38-oil sump body; 39-single-row
 radial ball bearing with two-side sealing; 40-sealing ring; 41-driving shaft flange; 42-filter;
 43-driving gear adjusting ring; 44-driven gear; 45-driven gear hub; 46-driven gear adjusting
 ring; 47-discharge nozzle; 48-discharge nozzle; 49-breather; 50-oil dipstick; 51-discharge
 nozzle; 52-drain plug; 53-oil unit body; 54-oil pump; 55-oil filter; 56-drain cock; 57-dis-
 charge nozzle; 58-safety valve; 59-magnetic plug.

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Motion to rod 2 is transmitted through the screw pair and splined guide bushing 14 enclosed in sleeve 21. Displacing of the rod by the amount indicated above ensures the required tail rotor blade turning range.

The entire rod unit is installed and removed from the tail gear box through the case hole protected by cover 25. Filler 13 of the case is provided with a threaded bushing for an eye bolt.

LUBRICATION OF TAIL GEAR BOX

The tail gear box has two lubrication systems; the main system is a forced type, the duplicating system being a splash one.

With the main lubrication system used, oil is supplied to the bearings and friction parts of the gear box by oil gear pump 54 (see Fig.177) mounted in oil unit body 53. The oil pump is driven by the gear machined on the shank of shaft 34. Installed in the oil delivery line are filter 55 and safety valve 58. Filter 42 is arranged at the pump inlet.

Just like the oil pump, oil filter 55, safety valve 58, and filter 42 are mounted in body 53 of the oil unit fixed with studs in oil sump 38. The oil unit body and the oil sump are cast of magnesium alloy. Oil from the pump is fed through filter 55 into the main duct of the gear box case (see Fig.177, Section B - B), whence it is carried through ducts to the following points of lubrication:

- (a) to discharge nozzles 29, 47, and 48 for lubricating the driving gear teeth, twin bearings of the driven gear and driven shaft;
- (b) to discharge nozzles 51 and 57 for lubricating the driven gear teeth and driven gear roller bearing 19 (see Section K - K);
- (c) to the rod sleeve for lubrication of the rod two-row bearing, rod splines, and slide.

Oil is fed to the rod two-row bearing from the rod sleeve through jet 18. The twin bearings of the driving gear are placed in a permanent oil bath, whereas roller bearing 28 is lubricated with oil mist formed during oil splashing.

In case the main (forced) lubrication system fails, the gear box is lubricated with the aid of the splash-type duplicating oil system. The splashed oil is dropped into special oil collecting pockets cast in the gear box case and filler. From the pockets the trapped oil is directed along a duct to the driven gear, driven shaft, rod, and sprocket bearings as well as to the screw pair.

The gear box is filled with oil through the hole of breather 49 or through that of oil dipstick 50. The oil level is checked with the help of oil dipstick 50 which has two marks: mark "H" (Russian letter) stands for the minimum oil level, and mark "B" (Russian letter), for the maximum oil level.

The oil from the gear box case is drained through drain cock 56 located in the lowermost point of the oil sump. Besides, there are two drain plugs 52 for draining oil from the case pockets. To catch the steel particles, provision is made for magnetic plug 59 (see Fig.177, Section M - M).

To measure the oil temperature in the oil sump, a hole intended for the temperature gauge pick-up unit is used (see Section A - A); the oil pressure at the pump outlet is measured through a hole for the pressure gauge pick-up made in the flange of oil filter 55. There is also a hole in the plug which serves to receive the pick-up of the oil temperature warning unit.

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The barrel-shaped splines of the flange of driving shaft 36 are lubricated with hypoid oil, State Standard IOCT 4003-53, fed through hole E.

2. INTERMEDIATE GEAR BOX

The purpose of the intermediate gear box is to change the direction of the tail shaft centre line by 47° . The intermediate gear box transmits the torque from the main gear box to the tail one with a slight reduction of the number of revolutions.

Basic Specifications

Direction of driving shaft rotation	clockwise (if viewed from main gear box, i.e. from oil sump end)
Same, driven gear shaft	clockwise (if viewed from intermediate gear box fan)
Gear ratio	$i = \frac{34}{35} = 0.9714$
Rated speed of driving gear shaft	2065 r.p.m.
Same, driven gear shaft	2006 r.p.m.

Lubrication

Lubrication method used	main system - forced lubrication; duplicating system (in case of main system failure) - splash lubrication
Type and quantity of oil pumps	one gear pump comprising only delivery stage
Grade of oil used:	
(a) in summer time	hypoid oil, State Standard IOCT 4003-53
(b) in winter time	mixture of 2/3 hypoid oil, State Standard IOCT 4003-53 (by volume), and 1/3 AMI-IO oil, State Standard IOCT 6794-53
Oil pressure	at least 0.5 kg/sq.cm at idle rating and at least 2 kg/sq.cm at other ratings
Oil temperature	$115^{\circ}\text{C} \div 125^{\circ}\text{C max}$
Amount of oil in gear box	7 litres
Weight of gear box (when dry)	100 kg

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CONSTRUCTION OF INTERMEDIATE GEAR BOX

The gear box (Fig.178) comprises one pair of bevel gears mounted in bearings inside case 10. The gear shaft axes are located at an angle of 47° with respect to each other ensuring the required bend in the transmission to the tail gear box.

Gear box case 10 is cast of magnesium alloy and has two flanges with holes for the sleeves of the driving and driven gears; the case outside and inside is fitted with ribs. The outer ribs serve for taking the heat away from the case walls, and the inner ones, for taking the heat away from the oil.

The case side walls are provided with four solid bosses, two on each side (see the side view in Fig.178). Mounted on the bosses with the aid of four studs are gear box attachment lugs 35 which secure the gear box to the helicopter pylon. The lugs are made from AK6 aluminum alloy.

The case has a port protected with cover 31 to inspect the gear mesh in the case.

Shafts 1 and 16 of the driving and driven gears, respectively rotate in three bearings each: two roller bearings 5 and one ball bearing 6. The roller bearings are intended to take up radial stresses, whereas the ball bearings take up axial loads only since they are mounted with clearances measured off their outer diameter.

Shaft 1, along with driving gear 12 and the bearings mounted on it, is installed in sleeve 7; shaft 16 with driven gear 22 and the bearings is arranged in sleeve 24.

Driving and driven gear sleeves 7 and 24 are cast from magnesium alloy. The sleeves are inserted into the holes made in gear box case 10 and secured to the latter with the aid of flanges and studs. The driving gear sleeve is provided with sealing rubber ring 8.

The oil cavities of the driving gear twin bearings and the driven gear roller bearing have two-stage labyrinth seals formed by the rectangular thread machined on the inner cylindrical surfaces of covers 4 and 18 and on the outer surfaces of output flanges 2 and 17.

To pass the oil dripping from the labyrinth first stage into the gear box case, holes are drilled in covers 4 and 18, sleeve 7, and case 10. The bearing cavity is protected against penetration of dust and dirt by felt glands 3 inserted into the inner recesses of covers 4 and 18.

The tail shaft tubes are secured to output flanges 2 and 17 splined to driving and driven gear shafts 1 and 16. The torque is transmitted from flange 2 to flange 17 through driving shaft 1, a pair of bevel gears 12 and 22, and driven shaft 16.

The driving gear has thirty-four, and the driven gear, thirty-five case-hardened teeth. The teeth are made helical to reduce the noise, increase their service life, and ensure smooth contact.

The gear mesh is adjusted by selection of adjusting rings 9 and 23.

Bolted to output flange 17 of the driven gear is fan impeller 19 cast from magnesium alloy integral with the blades. The fan impeller sucks in air through the space formed between the gear box wall and deflector 21. Fan diffuser 15 is a magnesium alloy casting, too, and is fitted with air flow straightening blades. The diffuser is secured to the gear box case.

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LUBRICATION OF INTERMEDIATE GEAR BOX

The gear box has two lubrication systems: the main (forced) and duplicating (splash) ones. The purpose of the latter is to ensure lubrication of the bearings in case the main system fails in operation. Oil for lubrication of the bearings and gears is forced in by oil gear pump 26 run by the shaft of the driven gear through shaft 28. The oil leaving the pump is passed into oil filter 29 whence it is carried in ducts made in case 10 and sleeves 7 and 24 to the following points of lubrication:

(a) to discharge nozzles 11 and 14 and to calibrated hole A for lubrication of the driving gear shaft bearings;

(b) to discharge nozzles 20 and 30 for lubrication of the driven gear shaft roller bearing and gear teeth.

The twin bearings of the driven gear shaft rotate in a permanent oil bath.

The oil delivery line is fitted with a safety valve. Oil intake 25 with a screen is arranged at the pump inlet.

The oil pump, oil filter, safety valve, and oil intake are arranged in case 27 of the gear box oil units. Case 27 is cast of magnesium alloy and secured to the gear box case on the side of driven gear sleeve 24 with the aid of a flange.

The splash lubrication system consists of special oil pockets trapping the splashed oil and of drillings made in the case and sleeves 7 and 24. These drillings serve to direct oil from the pockets to all the driving gear shaft bearings and to the upper roller bearing of the driven gear shaft.

Oil is filled into the gear box through a filler closed with plug 33. Oil dipstick 32 serves to check the oil level in the gear box. Lower mark "H" (Russian letter) of the dipstick stands for BOTTOM and corresponds to the minimum oil level, whereas upper mark "B" stands for TOP and indicates the maximum oil level.

If required, the oil can be drained from the gear box case through drain cock 36. Magnetic plug 34 serves for catching the steel particles suspended in the oil. The oil temperature in the gear box is measured through a hole (Section B-B) made in the oil unit case to receive the pick-up unit of the oil temperature gauge; provided in the flange of oil filter 29 is a hole for pick-up unit of the pressure gauge which indicates the pressure exerted by oil at the oil pump outlet. A hole is also made in the lower portion of oil unit case 27 for the pick-up of the oil temperature warning unit.

The inner cavity of the gear box communicates with the atmosphere through the clearances formed in the shaft labyrinth seals.

The gear box case is provided with eye bolt 13 located in its upper part.

3. TRANSMISSION TAIL SHAFT

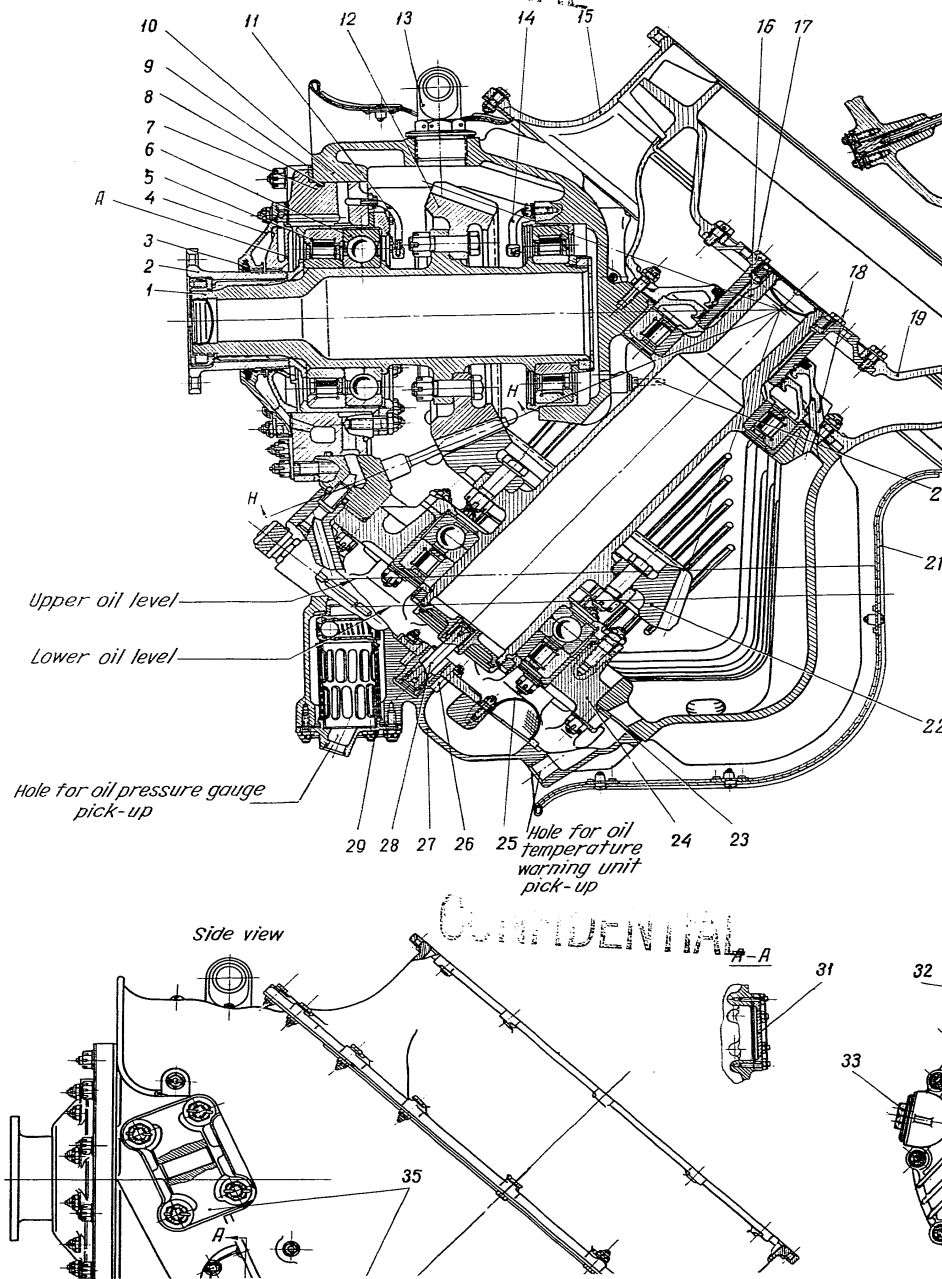
The tail shaft serves to transmit the torque from main gear box to tail gear box (through the intermediate one).

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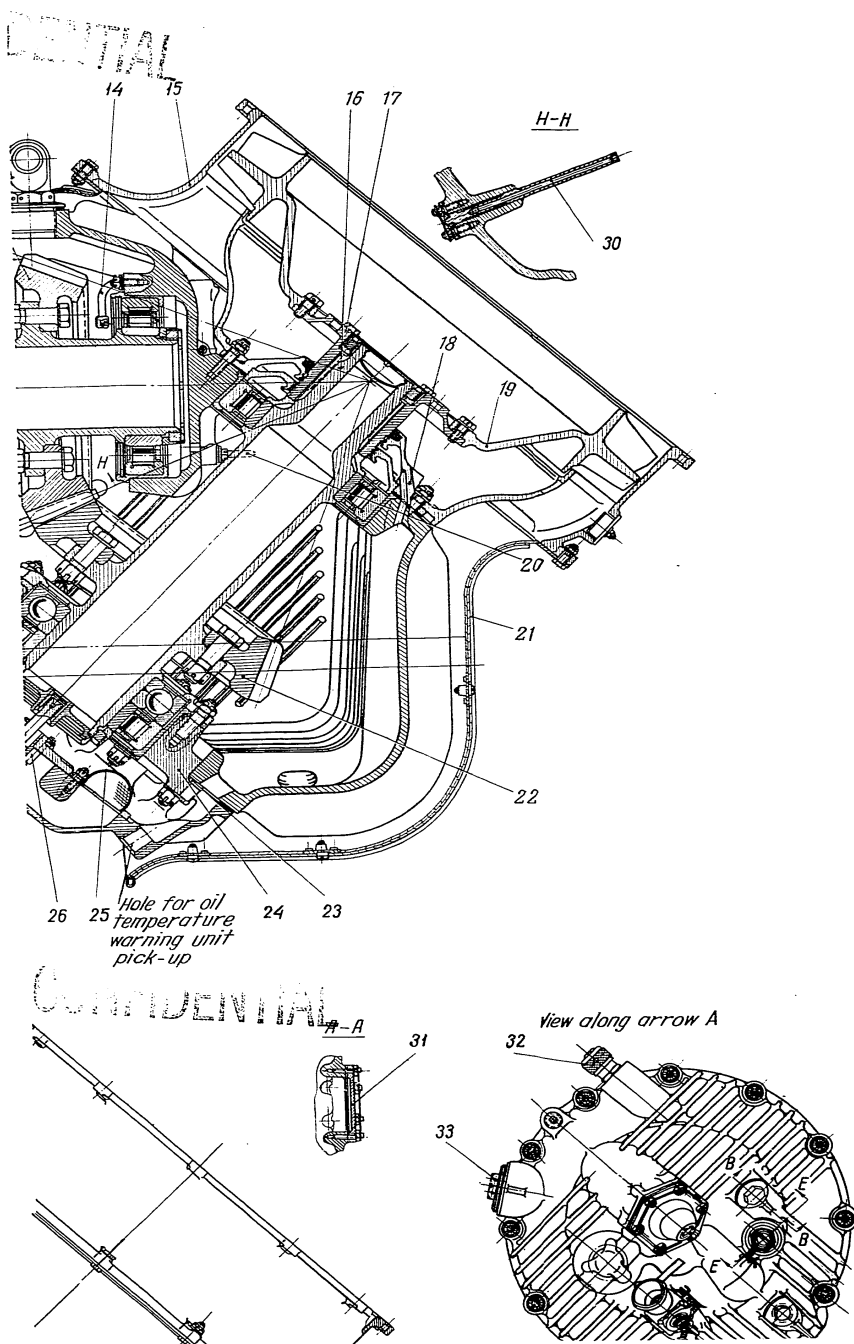
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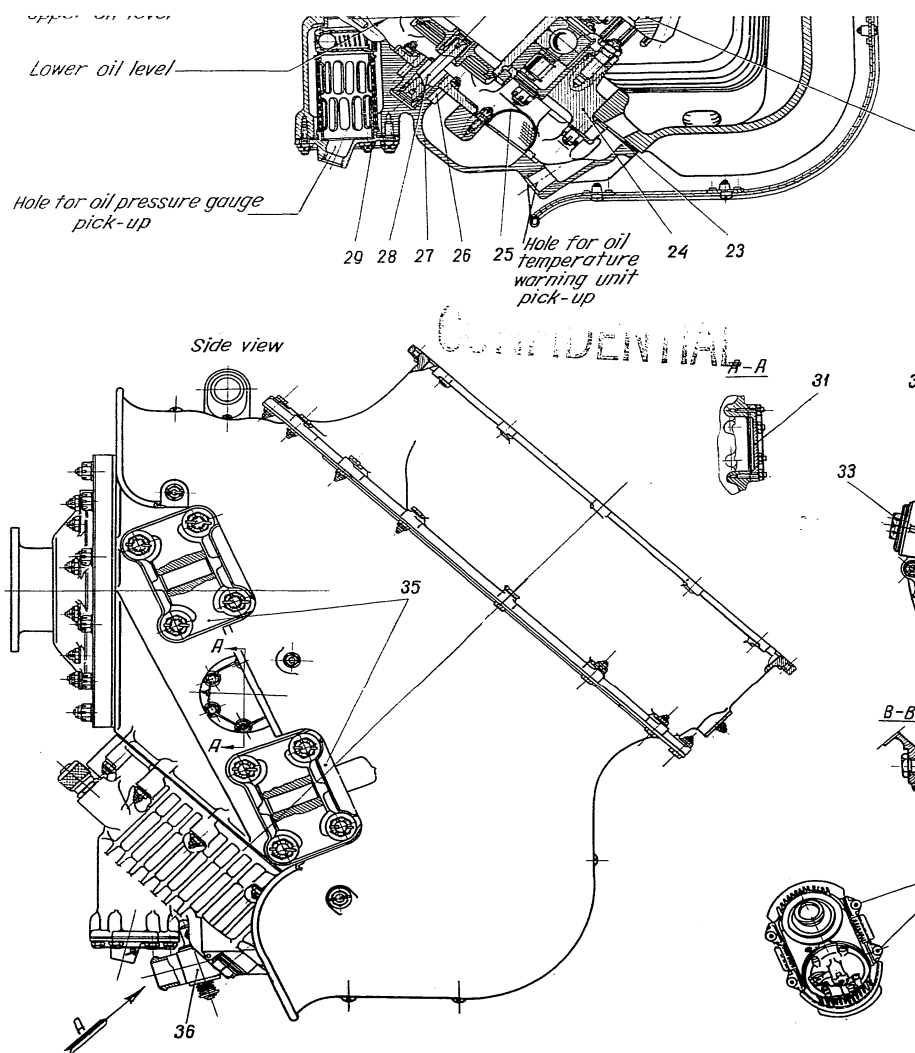


FIG. 178. INTERMEDIATE GEAR BOX

1-driving shaft; 2-driving gear output flange; 3-felt gland; 4-driving shaft cover; 5-roller bearing; 6-ball bearing; 7-sleeve for driving gear bearings; 8-rubber ring; 9-adjusting ring; 10-gear box case; 11-discharge nozzle; 12-driving gear; 13-eye bolt; 14-discharge nozzle; 15-diffuser; 16-driven shaft; 17-driven gear output flange; 18-cover; 19-fan impeller; 20-discharge nozzle; 21-deflector; 22-driven gear bearing; 23-oil intake; 24-oil filter; 25-oil filter; 26-oil filter; 27-oil filter; 28-oil filter; 29-oil filter; 30-discharge nozzle; 31-filling plug; 32-magnetic plug; 33-cock; A-cal

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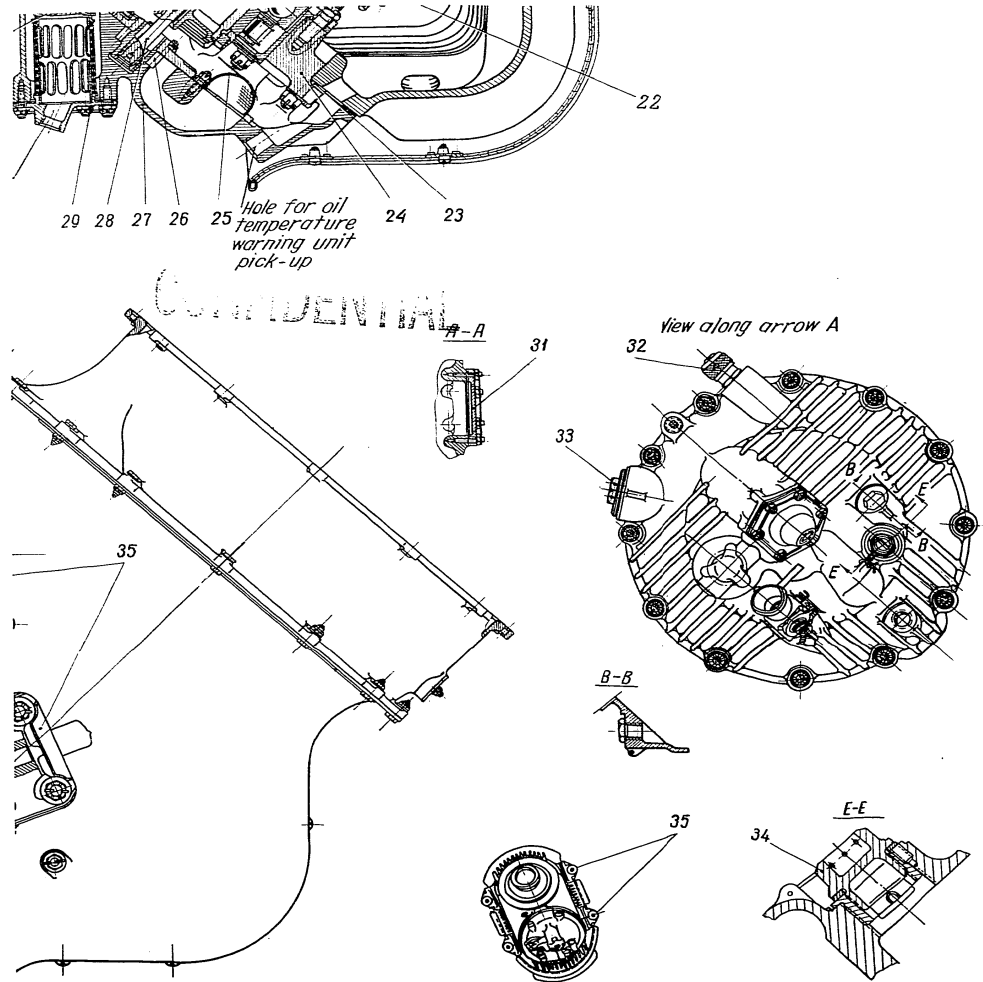


FIG. 178. INTERMEDIATE GEAR BOX

output flange; 3—felt gland; 4—driving shaft
 bearing; 7—sleeve for driving gear bearings;
 10—gear box case; 11—discharge nozzle;
 12—discharge nozzle; 15—diffuser; 16—driven
 gear; 18—cover; 19—fan impeller; 20—discharge

nozzle; 21—deflector; 22—driven gear; 23—adjusting ring; 24—sleeve for driven
 gear bearing; 25—oil intake; 26—oil gear pump; 27—case of oil units; 28—shaft;
 29—oil filter; 30—discharge nozzle; 31—inspection port cover; 32—oil dipstick;
 33—filling plug; 34—magnetic plug; 35—gear box attachment lugs; 36—drain
 cock; A—calibrated hole.

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Basic Specifications

Direction of rotation:

- (a) main-to-intermediate gear box
shaft portion clockwise (if viewed from
main gear box)
- (b) intermediate-to-tail gear box
shaft portion counterclockwise (if viewed
from intermediate gear box)

Rated speed:

- (a) main-to-intermediate gear box shaft
portion 2065 r.p.m.
- (b) intermediate-to-tail gear box
shaft portion 2006 r.p.m.
- Grade of oil used hypoid oil, State Standard
IOCT 4003-53
- Weight of tail shaft (when dry) 212 kg

CONSTRUCTION OF TRANSMISSION TAIL SHAFT

The main and intermediate gear boxes are interconnected by the long horizontal portion of the tail shaft. The inclined end portion of the tail shaft interconnects the intermediate and tail gear boxes.

The tail shaft (Fig.179) comprises eleven tubes 1 connected to one another with the aid of splined couplings and flanges. Each flanged connection is tightened up with twelve bolts; the latter also serve for centring the tubes.

The tail shaft is provided with nine supports on which it rests when installed in the helicopter. The supports are attached to the tail boom and pylon frames with bolts.

Tail shaft support 2 (unit II) is cast of MJ15 magnesium alloy and has a recess mounted in which on rubber seat 3 is closed-type radial ball bearing 4 press-fitted onto splined coupling sleeve 5. The bearing is packed with special grease for its entire service life. Rubber seat 3 ensures compensation for the misalignment which results from inaccuracy in support installation. The seat also serves for damping the transverse oscillations of the shaft.

Support 9 arranged in the helicopter pylon (unit V) is fitted with a round flange by means of which it is bolted to the frame. This support differs from support 2 in that it ensures free axial displacement of the shaft portion secured to the intermediate gear box flange. This displacement of the shaft is necessary to compensate for the inaccuracy in the shaft section lengths and for elongation of the pylon and shaft due to heat expansion.

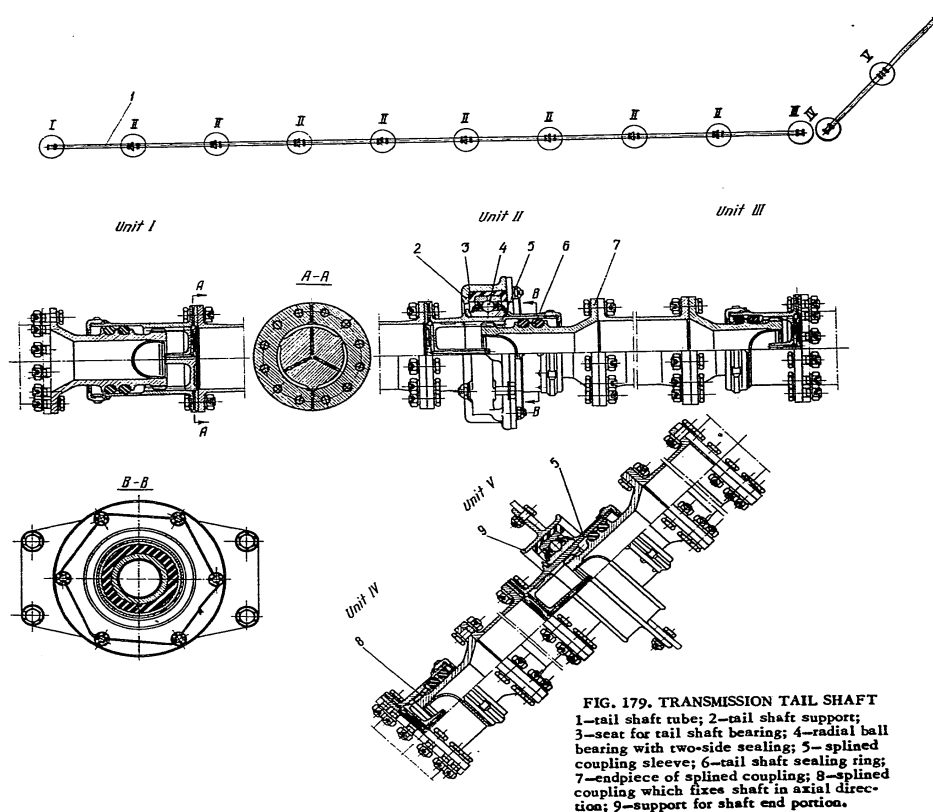
The splined coupling consists of outer sleeve 5 with long internal splines and inner endpiece 7 having short barre' shaped splines. The spline cavity is sealed with two rubber rings 6.

The function of the splined coupling is to compensate for probable misalignment of separate tube sections and inaccuracy in tube and tail shaft inter-support lengths, as well as to compensate for the difference in the heat expansion values of the helicopter tail shaft and tail boom.

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Splined couplings 8 (units III and IV) of those shaft sections which are connected to the intermediate gear box flanges differ from other couplings in that they fix the shaft in the axial direction.

The splined couplings are filled with oil by means of a squirt through one of the two holes drilled in the coupling outer flange (see Section A-A). The couplings are lubricated with hypoid oil, State Standard IOCT 4003-53.

4. MAIN ROTOR BRAKE

The purpose of the main rotor brake is to brake up the transmission when the helicopter is parked.

Basic Specifications

Direction of brake drum rotation	counterclockwise (if viewed from brake drum)
Brake drum rated speed	2065 r.p.m.
Weight of brake	34 kg

CONSTRUCTION OF MAIN ROTOR BRAKE

The brake (Fig.180) consists of support 1, mounted on which are brake shoes 2 with levers 3, and of drum 4. The brake support is fastened to the case of the main gear box, and the drum, to the flange of the main gear box tail output shaft.

As an effort is applied to brake lever 5, cam 6 splined to it starts turning to exert pressure on levers 3 which are articulated to brake shoes 2. The latter ones are turned about their fulcrum pins 7 secured in the support. After the clearance is taken up, the friction linings of the shoes are pressed against brake drum 4, thus applying the brake to the rotating drum.

Brake lever 5 being released, springs 8 cause the brake shoes and levers 3 to reassume the initial position, thus removing the brake.

The brake is adjusted with the aid of adjusting screws 9 and screw 11 in the following way. A minimum clearance of 0.15 to 0.25 mm is set up between the shoes and the drum with the aid of adjusting screw 9. This done, screw 11 is turned to adjust the clearance between the flat faces of cams 6 and the bearing surfaces of levers 3. This clearance is checked by measuring the play of brake control lever 5, which should equal 0.5 to 3.5 mm at a distance of 200 mm from the lever rotation axis.

Screws 9 are locked by ball 10, and screw 11, by plate spring 12.

5. FAN ASSEMBLY

The purpose of the fan is to supply cooling air to the engine and main gear box oil coolers, the CIC-80/360 generators of the de-icing system, the CIT-I2TM starter generators, the air compressor, and hydraulic pumps #662^Q. The fan is also used

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for supply of cold or warm air into the helicopter cabins and cargo compartment for ventilation or heating purposes.

Basic Specifications

Direction of impeller rotation	clockwise (if viewed from fan air inlet)
Rated speed of fan impeller	3038 r.p.m.
Impeller outer diameter	800 mm
Rated fan output at ambient air temperature of +40°C	16.0 cu.m/sec
Rated delivery head at ambient air temperature of +40°C	700 mm of water column
Fan weight (complete with cardan shaft)	141 kg

CONSTRUCTION OF FAN ASSEMBLY

The air flow path of the fan (Fig.181) is formed by the circular cavities in guide vane assembly housing 7 and fan drive housing 9. The guide vane assembly housing is cast of magnesium alloy. Attached to the inner flange in the front portion of the housing is magnesium fairing 1. The fan drive housing is secured to the outer rear circular flange.

Twenty-one blades 6 are equispaced over the circumference of the guide vane assembly circular cavity. Blades 6 are cast from magnesium alloy. They may be turned in ball bearings about their pins 5, when it is required to change the blade setting angles. Blade pins 5 have eccentric shanks articulated to one another with the aid of rods 4 and ring 2. The inner groove of the ring rests on three ball bearings equispaced over the circumference in the guide vane assembly housing on pins 3.

All the blades are turned simultaneously by means of carrier 28 fixed on the thick pin of one of the blades. Carrier 28 is connected with the MI-100M electrical actuator whose tumbler switch is arranged on the flight engineer's instrument panel. Located on the same panel is the blade position indicator. To ensure rapid closing of the blades, thus creating better fire-extinguishing conditions, there is made of hydraulic cylinder 20 in addition to the MI-100M electrical actuator. The cylinder is controlled automatically by solenoid-controlled hydraulic valve IA-163.

Eye 19 of hydraulic cylinder 20 is secured to attachment fitting 17 by bolt 18. Hydraulic cylinder rod 21 is suspended from the eye of bell crank 23 which is free to turn about bolt 22. The other eye of the bell crank is fixed to the MI-100M electrical actuator whose rod 25 is coupled with fan blade turning carrier 28.

The fan housing carries bracket 29 mounted on which is limit switch 26 whose purpose is to switch off the IA-163 valve controlling the hydraulic cylinder.

Fan rotor disc 8, cast integral with twenty blades from magnesium alloy, is bolted to the flange of fan drive shaft 30. The latter runs in two closed-type ball bearings located in drive housing 9. The ball bearings are packed with grease for their entire service life.

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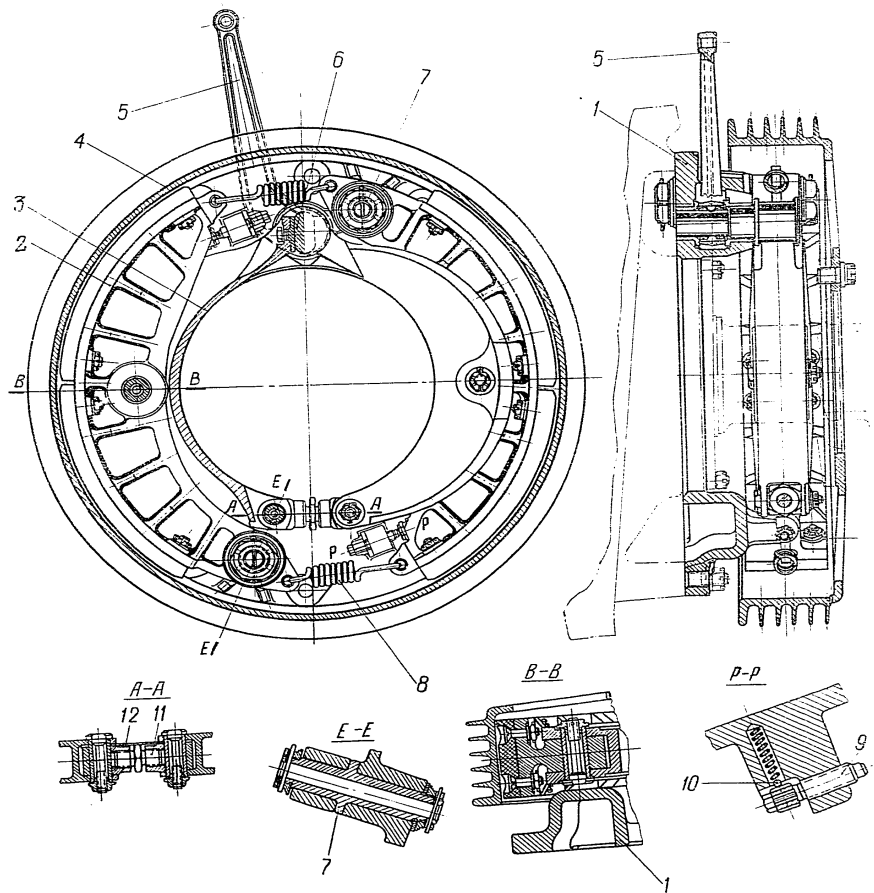


FIG. 180. MAIN ROTOR BRAKE

1—brake support; 2—brake shoe; 3—brake shoe lever; 4—brake drum; 5—brake control lever; 6—brake cam;
 7—brake shoe fulcrum pin; 8—brake shoe spring; 9—brake shoe adjusting screw; 10—ball; 11—brake shoe
 lever adjusting screw; 12—adjusting screw locking spring.

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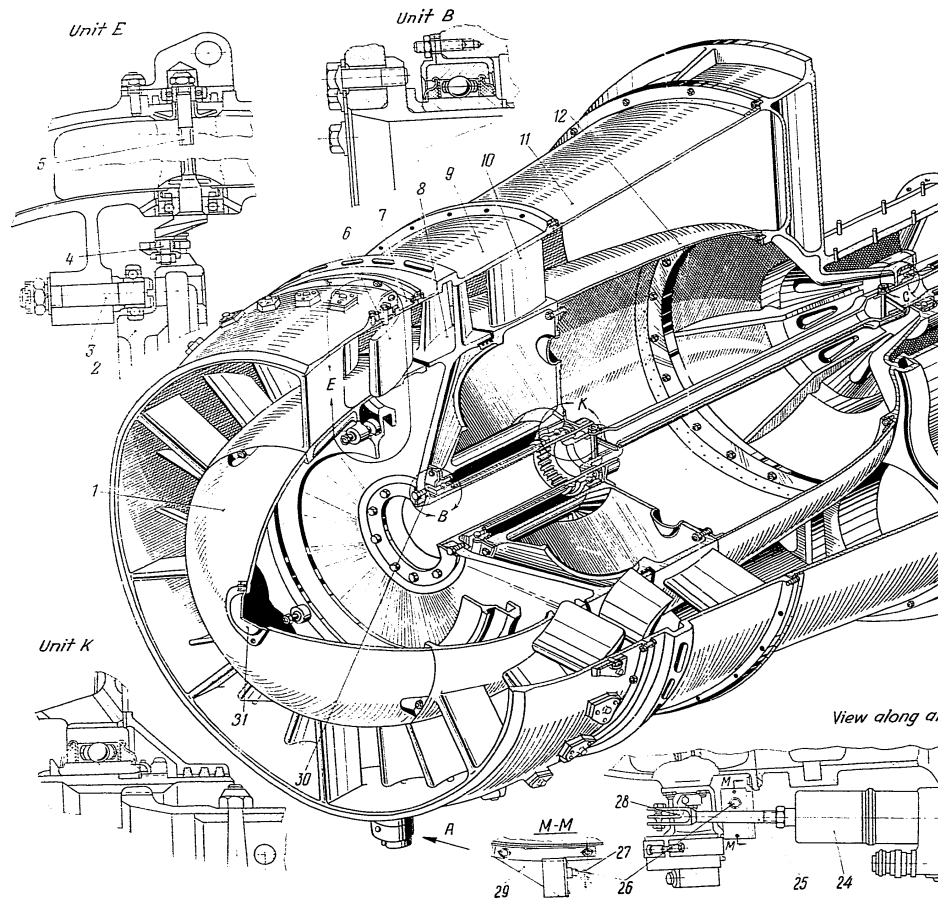
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FIG. 181. FAN ASSEMBLY

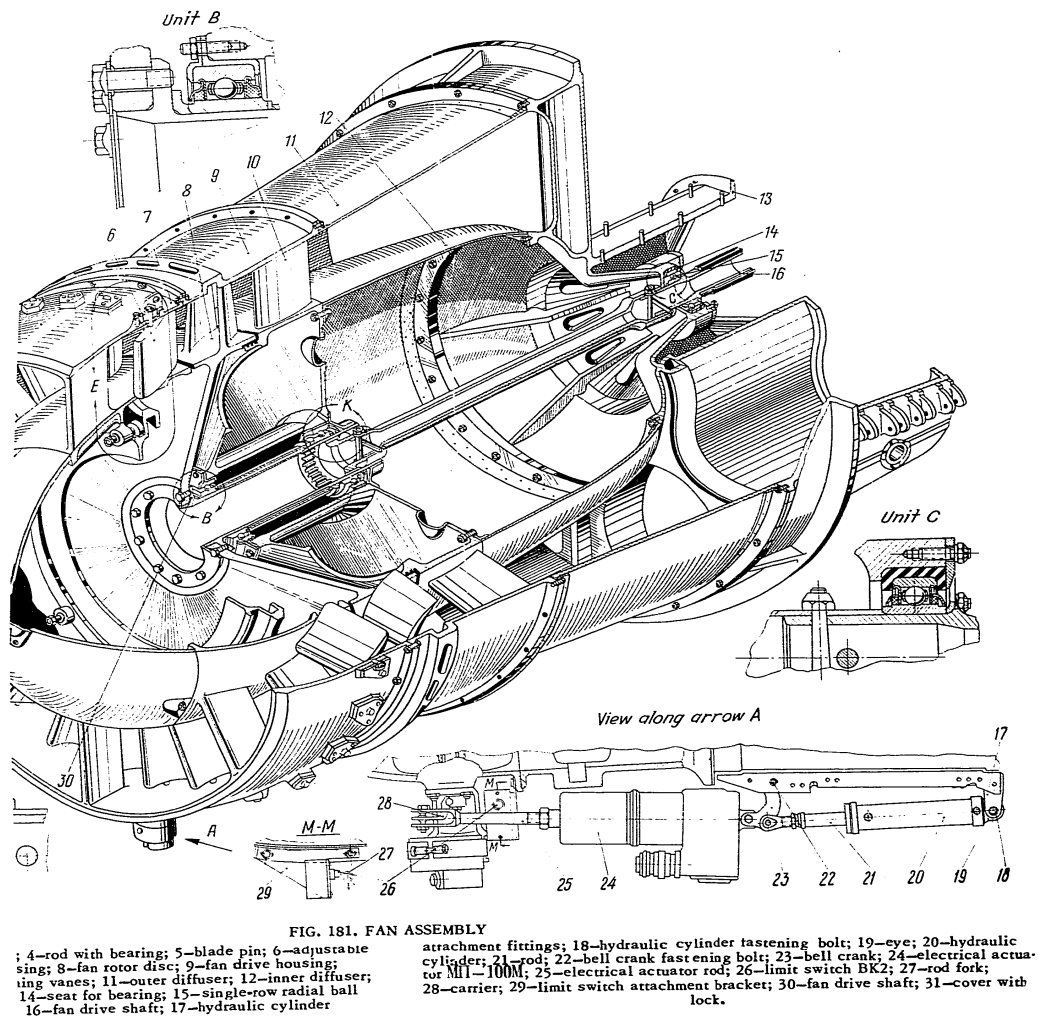
1-fairing; 2-ring; 3-eccentric pin; 4-rod with bearing; 5-blade pin; 6-adjustable blade; 7-guide vane assembly housing; 8-fan rotor disc; 9-fan drive housing; 10-fan drive housing air straightening vanes; 11-outer diffuser; 12-inner diffuser; 13-oil cooler attachment housing; 14-seat for bearing; 15-single-row radial ball bearing with two-side felt sealing; 16-fan drive shaft; 17-hydraulic cylinder

attachment fittings; 18-hydraulic cylinder; 21-rod; 22-bell crank fastener M11-100M; 25-electrical actuator; 28-carrier; 29-limit switch attachment

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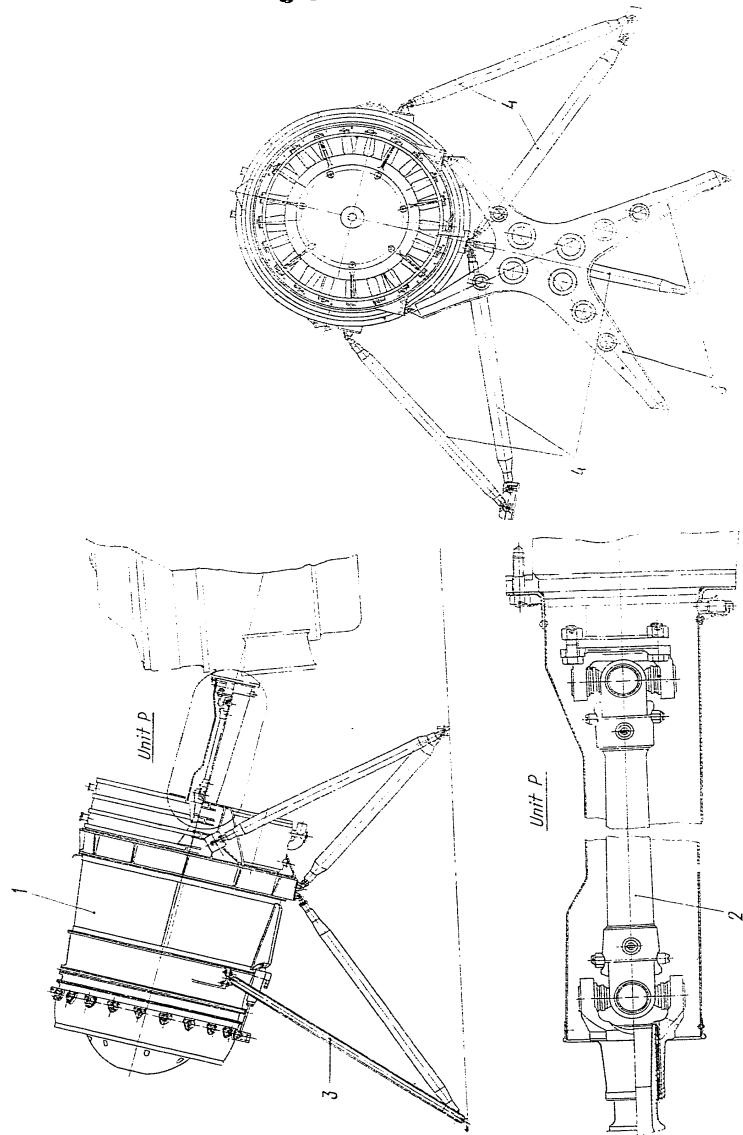
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The impeller rim is provided on one side with an air-type labyrinth seal. Located in the circular cavity of drive housing 9 behind the blades of fan rotor disc 8 are nineteen fixed air straightening vanes 10 cast from magnesium alloy integral with drive housing 9.

On leaving the air straightening vane cavity, air enters the circular space formed by outer diffuser 11 and inner diffuser 12 to pass into the oil coolers mounted on cast housing 13. The latter serves also for the attachment of ball bearing 15 and fan drive shaft 16. Closed-type ball bearing 15 is packed with special lubricant for its entire service life period.

To compensate for possible misalignment, the ball bearing is arranged in its support on rubber seat 14. The splined end of drive shaft 16 enters the splines machined on fan drive shaft 30. The other end of drive shaft 16 is coupled with the splined fork of cardan shaft 2 (see Fig.182).

The fan is driven off the main gear box through cardan shaft 2.

The fan assembly is secured to the helicopter fuselage by means of fan attachment spider 3 of riveted construction and five brace struts 4. The fan attachment fittings are located on frames Nos 10 and 14 of the fuselage central part.

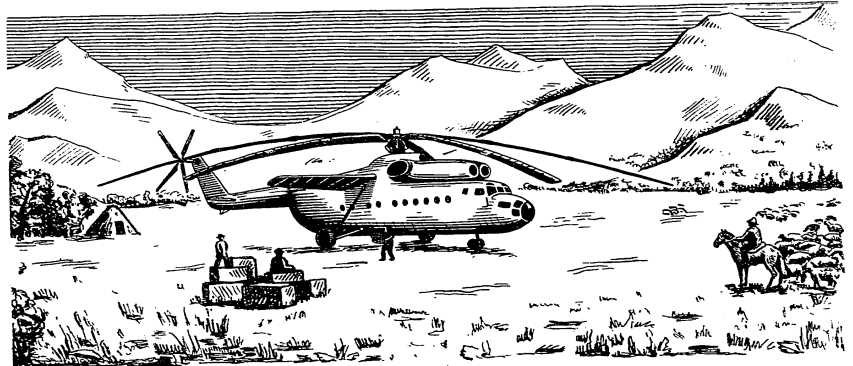
Fan drive shaft splines 30 (Fig.181) serve also for cranking the helicopter transmission prior to starting the engines. This is accomplished with the aid of a special wrench inserted through the hole made in fairing 1. The hole is closed by cover 31 provided with a lock. The cover is attached to a hinge riveted to the fairing.

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Chapter VI

HELICOPTER CONTROL SYSTEM

GENERAL

Helicopter control with regard to the three axes of its movement is accomplished by changing the value and direction of the main rotor thrust, as well as by changing the value of the tail rotor thrust.

The helicopter is controlled in the longitudinal and lateral directions by means of the control stick. By deflecting the control stick, the pilot changes the position of the swashplate and, hence, the inclination angle of the main rotor thrust resultant. This is achieved due to the cyclic change of the blade setting angle in various azimuth positions.

Directional control of the helicopter is accomplished by operating the foot pedals, thus changing the tail rotor pitch and, consequently, thrust.

To create the required effort gradient on the control stick (i.e. simulate the resistance offered by the linkage), as well as to remove this resistance from the stick at various stable flying conditions, use is made of spring feel mechanisms introduced into both the hand and foot control systems of the helicopter.

The spring feel mechanisms incorporated in the hand control system are operated with the aid of the MI-100M electrical actuators. The latter are cut in or out by means of a selector switch located in the upper part of the control stick. The foot control system electrical actuator is controlled with the aid of limit switches and foot actuators located on the supporting plates of the control pedals.

The change of the main rotor thrust is effected by changing the rotor collective pitch and the engine rating. This is done by operating the combined collective pitch - throttle control lever.

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Displacement of the lever results not only in a change of the main rotor collective pitch and engine rating, but also in a respective change of the stabilizer setting angle.

In addition to the combined collective pitch-throttle control system, the helicopter is provided with an engine selector control system which permits testing of each engine without changing the collective pitch of the main rotor and allows selection of the required engine rating while in flight with only one engine running.

The main rotor collective pitch and the position of the spring feel mechanisms are checked by the pilot through reference to the indicators located on the instrument panel.

The helicopter control system incorporates two-chamber hydraulic boosters operating on a non-reversible principle.

The helicopter control system (see Fig.183) is of the dual type and, essentially, comprises rigid structural members. Control cables are used only in the tail rotor and stabilizer controls arranged in the fuselage tail part, tail boom, and pylon.

To facilitate installation and adjustment of the control system components, especially under field conditions, these components may be fixed in their neutral positions. This is achieved with the aid of pins inserted into the holes in the foot pedals, control column, and the bell cranks on frame No.14.

The helicopter control system includes:

1. Hand controls connecting the longitudinal and lateral control column with the swashplate.
2. Foot controls connecting the pedals with the tail rotor.
3. Combined collective pitch - throttle - stabilizer controls whose collective pitch - throttle control lever is connected with the swashplate slide and the HP-23 pump control levers.
- The stabilizer is coupled through a control linkage to the swashplate slide.
4. Engine selector controls comprising two levers interconnected with the levers of the HP-23 pump.
5. Controls of the spring feel mechanisms including a spring-opened electrical switch, that is located on the control stick, and the pedal actuators with limit switches.
6. Transmission brake controls connecting the control stick with the brake lever on the main gear box.

HAND CONTROL SYSTEM

The dual-type hand control system (Figs 183 and 184) is of a rigid construction and comprises a control column, a system of rods and bell cranks, two hydraulic boosters, and the swashplate. One control line with a hydraulic booster incorporated in it serves for longitudinal control, and the other, for lateral control of the helicopter.

The longitudinal and lateral control lines employ spring feel mechanisms which create the required effort gradient on the control stick. These mechanisms are controlled with the help of switches located in the upper parts of the control sticks. Such arrangement of the switches permits the pilots to unload the control stick without removing the hand from the latter.

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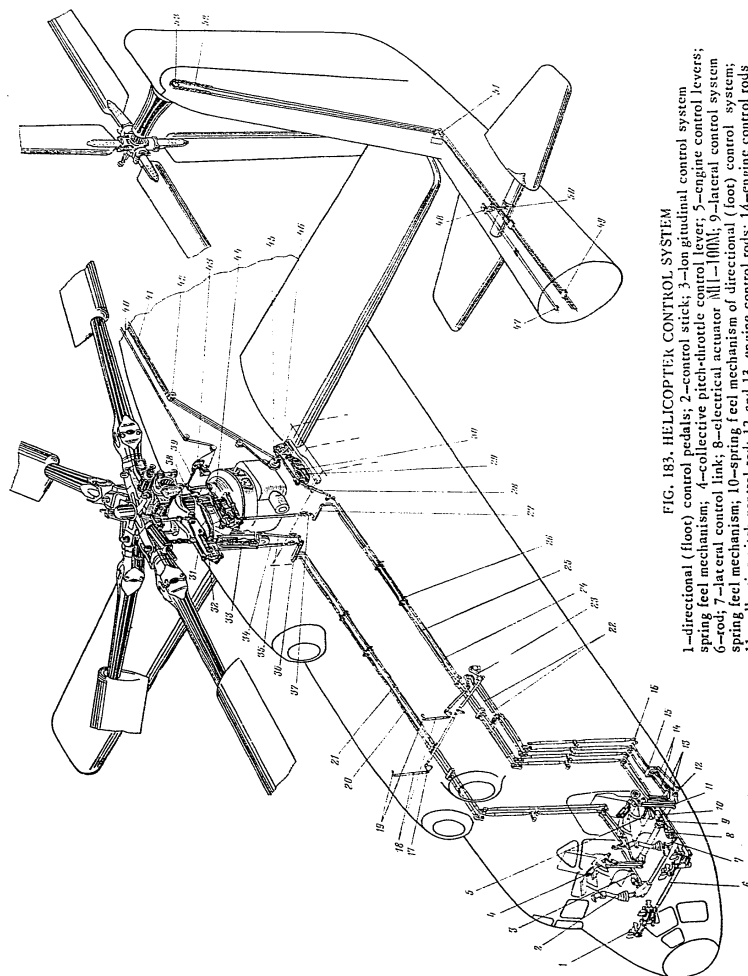


FIG. 183. HELICOPTER CONTROL SYSTEM

1—directional (foot) control pedals; 2—control stick; 3—longitudinal control system spring feel mechanism; 4—collective pitch-droottle control lever; 5—engine control levers; 6—rod; 7—lateral control link; 8—electrical actuator M11-11000; 9—lateral control system spring feel mechanism; 10—spring feel mechanism of directional (foot) control system; 11—collective pitch control rod; 12 and 13—engine control rods; 14—engine control rods connected to levers; 15—differential unit; 16—bell cranks with adjustable stops; 17—engine control unit; 18—engine control rods; 19—engine control levers; 20—longitudinal control rod; 21—collective pitch control rods; 22—engine control rods; 23—engine control rods; 24—collective pitch control rods; 25—lateral control rods; 26—pully guides; 27—bell cranks; 28, 34, 35, and 37—rods with spring devices; 29—foot control system hydraulic booster; 30—rod; 31—rod; 32—longitudinal control hydraulic booster; 33—collective pitch control hydraulic booster; 36—bell crank; 38—attachment unit for connecting stabilizer control to washplate slide; 39—rod; 40—stabilizer control cables; 41—foot control cables; 42—pulleys; 43—sector; 44—rod; 45—drum; 46—step-up gear; 47 and 49—textile guides; 48—stabilizer control mechanism; 50—rod; 51—pulleys; 52—bushed roller chain; 53—sprocket.

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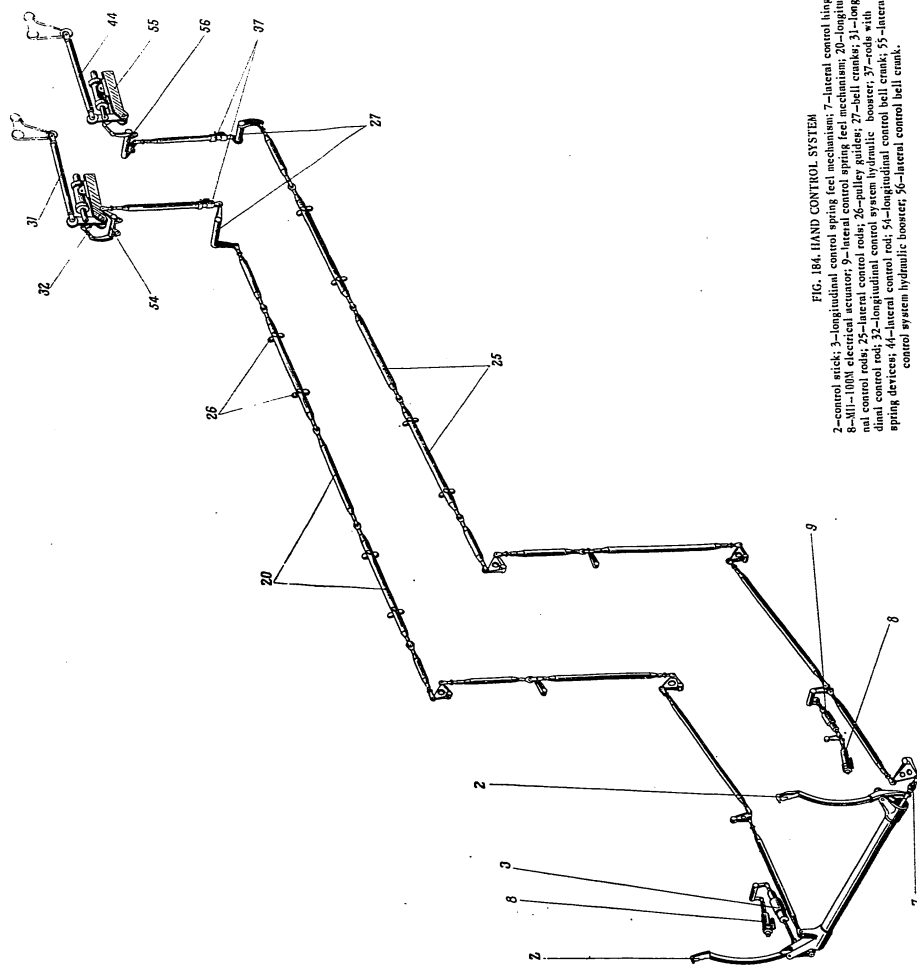


FIG. 184. HAND CONTROL SYSTEM
 2—control stick; 3—longitudinal control spring feel mechanism; 7—lateral control hinge;
 8—lateral control spring feel mechanism; 9—lateral control rod; 20—longitudinal
 control rod; 25—lateral control rod; 26—pulley guide; 27—bell crank; 31—longitudinal
 control rod; 32—longitudinal control system hydraulic booster; 37—rod with
 dial control rod; 44—lateral control rod; 54—longitudinal control bell crank; 55—lateral
 control system hydraulic booster; 56—lateral control bell crank.

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The control column (Fig.185) is made as a separate unit secured to the pilots' cabin floor with the aid of brackets and bolts. The brackets form an integral part of the floor framework. The control column comprises two control sticks 1, articulated to pivots 7 of tubular shaft 14, and two brackets 8. The lower ends of the control sticks are joined by rod 13 passed inside the tubular shaft.

The shaft is mounted in brackets and runs in ball bearings. Dirt is prevented from getting inside the ball bearings by felt packing 12. Pivots 7 are made from AK6 aluminum alloy and are press-fitted onto the shaft, being secured with nut 10 and tapered bolts 11.

The right-hand pivot (as viewed in the direction of flight) is fitted with a fork for attaching the longitudinal control rod. Displacement of the control sticks in the longitudinal direction is limited by stop 6 installed on the left-hand pivot. Motion of the sticks is limited with the aid of adjustable bolts 5 screwed into bracket 8. Lateral displacement of the control sticks is restricted by bolts 9 screwed into both pivots. The control sticks can be fixed in both the lateral and longitudinal directions by means of holes 17 made in bracket 8 and pivot 7.

Rod 13 runs crosswise to couple the control sticks to each other; connected to rod fork 16 is the lateral control line.

Each control stick is made from a duralumin tube. The lower end of the tube is provided with a steel endpiece, whereas the upper end is fitted with handle 2. The handle of the pilot carries main L.G. wheel brake control 3.

The handle body (Fig.186) is cast of AMG alloy. The surface of the handle is covered with rubber just where it is gripped by the pilot. Located in the upper part of the handle is spring feel mechanism combined control switch 2 and three ON-OFF buttons: radio set button 1, intercom system button 4, and autopilot button 3.

To avoid short-circuiting, the recesses for the switch and buttons are insulated with sheet pressboard just where the wires are soldered to the terminals. The electrical wires are led from the switch and buttons inside the handle and the control stick tube. The bunched wires are brought out of the tube through a hole in its lower part arranged close to the control stick axis of rotation. The wires are terminated on a plug connector.

Bolted to the lower part of the handle is weight 18 (see Fig.185) of 1.6 kg serving to reduce the control stick lateral oscillation frequency and to obviate the possibility of control stick oscillations while in flight with the autopilot switched on. Access to the electrical wires led inside the handle body is provided through a port blanked off by weight 18. The co-pilot's control stick is similar in design with the pilot's one, differing from the latter only in that it has no wheel brake control incorporated.

Running from the control column to the right of the fuselage centre line are the longitudinal control rods, and to the left of it, the lateral control rods (see Figs 183 and 184). In the pilots' cabin the control rods are arranged under the floor, and in the cargo compartment, inside the compartment under detachable protective casings. The rods are brought out of the cargo compartment and passed into the gear box compartment near fuselage frame No.14. Here the upper ends of the rods are connected to the bell cranks mounted on the hydraulic boosters.

The hydraulic boosters of the longitudinal and lateral control systems (Figs 187 and 188) are mounted in a similar way.

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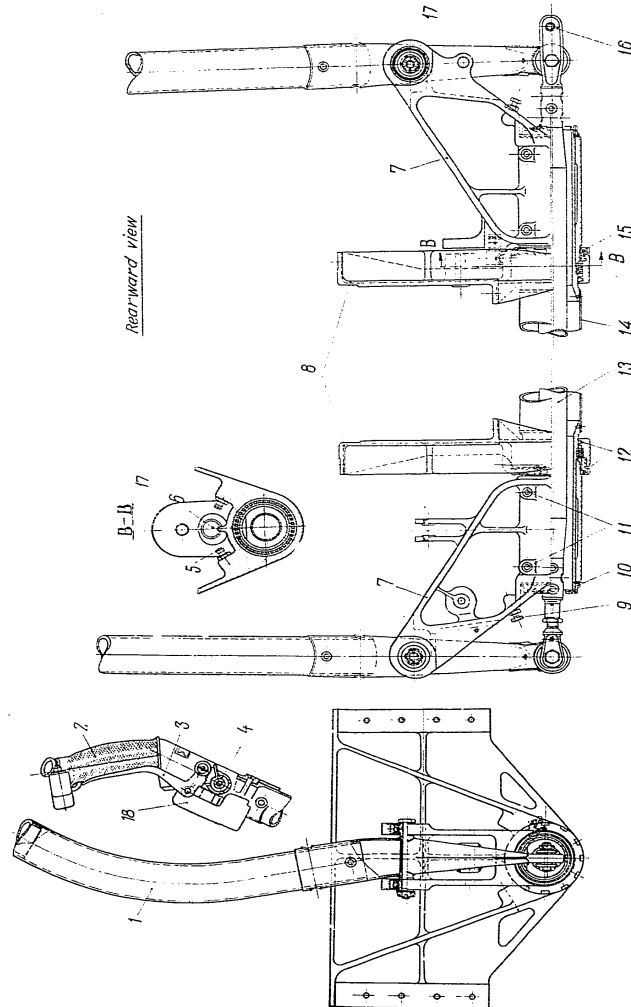


FIG. 185. CONTROL COLUMN

1-control stick; 2-handle; 3-L.G. wheel brake control; 4-brake control latch; 5-limiting bolt; 6-stop; 7-pivot; 8-backer; 9-limiting bolt; 10-nut; 11-tapered bolts; 12-felt packing; 13-out; 14-shaft; 15-nut; 16-rod fork; 17-filing hole; 18-weight.

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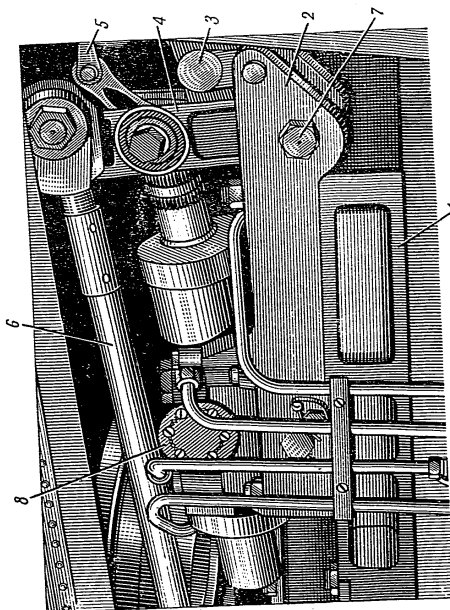


FIG. 187. INSTALLATION OF HAND CONTROL SYSTEM HYDRAULIC BOOSTER
1—bracket; 2—hydraulic booster; 3—bell crank; 4—hydraulic booster bell crank; 5—link; 6—rod; 7—hydraulic booster bell crank bolt; 8—hydraulic booster function.

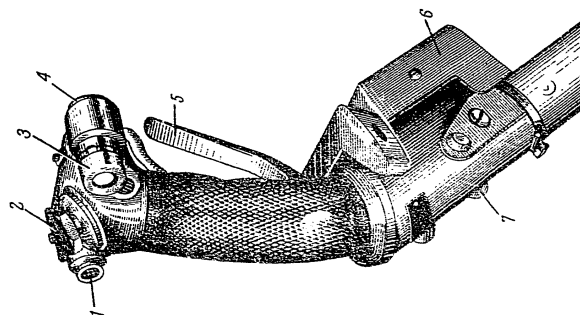


FIG. 186. LEFT-HAND CONTROL STICK HANDLE
1—radio set ON-OFF button; 2—spring feel mechanism control switch; 3—autopilot ON-OFF button; 4—intercom system ON-OFF button; 5—L.G. wheel brake control; 6—weight; 7—wheel brake control latch.

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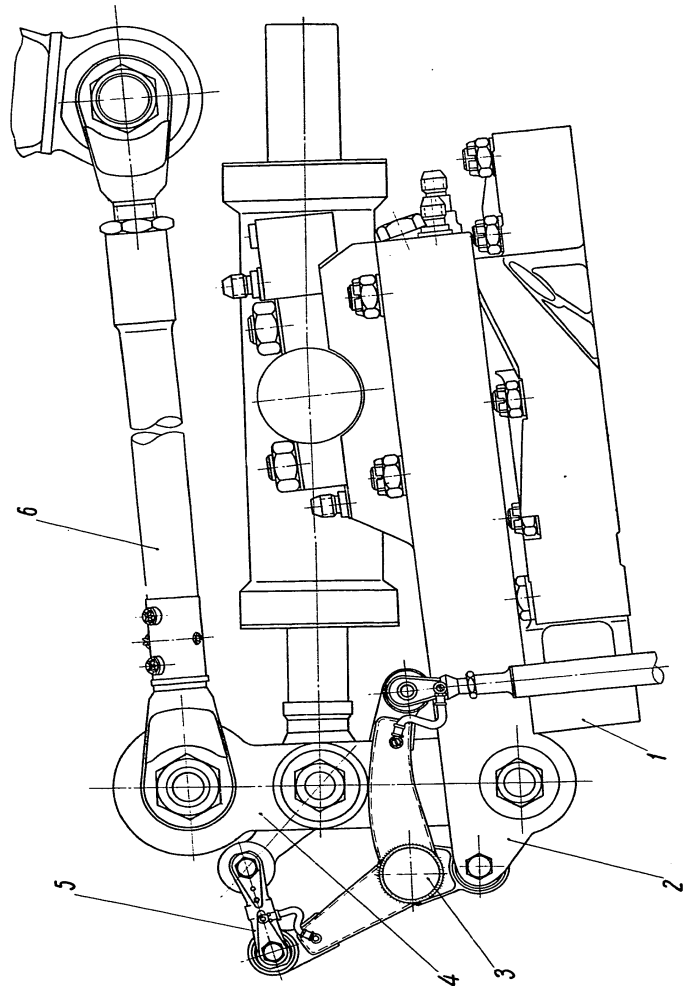


FIG. 188. INSTALLATION OF LONGITUDINAL CONTROL HYDRAULIC BOOSTER
1-bracket; 2-hydraulic booster; 3-bell crank; 4-hydraulic booster bell crank; 5-link; 6-rod.

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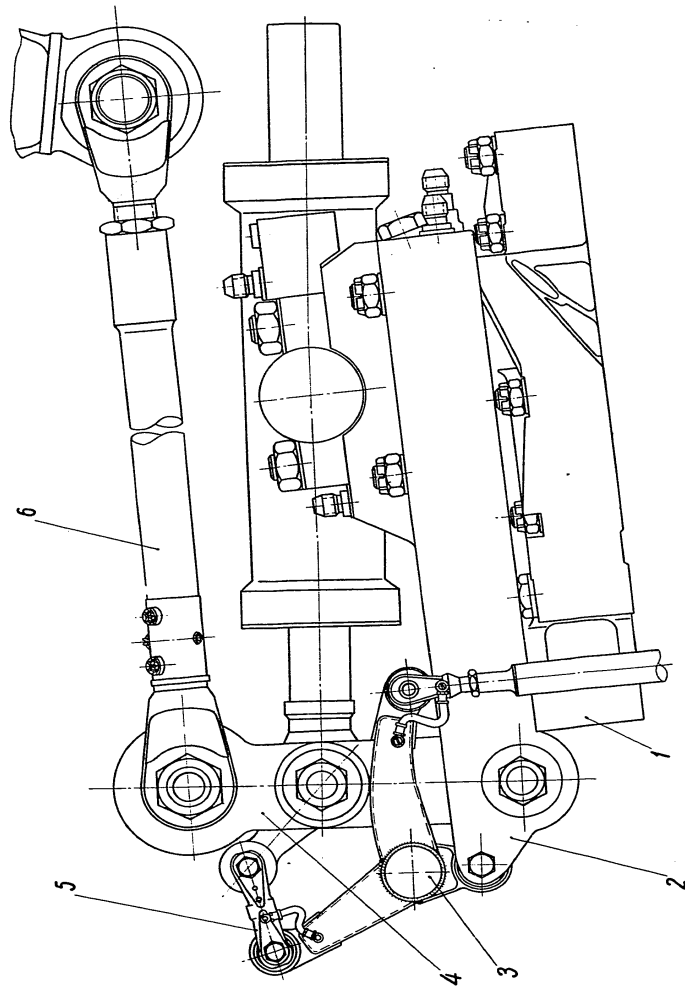


FIG. 188. INSTALLATION OF LONGITUDINAL CONTROL HYDRAULIC BOOSTER
1-bracket; 2-hydraulic booster; 3-bell crank; 4-hydraulic booster bell crank; 5-link; 6-rod.

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The BY-33A hydraulic boosters operate on a non-reversible principle.

Each booster is secured to bracket 1 with six studs. The stud nuts are tightened with the aid of a torque-indicating wrench. The brackets are fabricated from AK6 aluminum alloy and are installed on the bosses of the main gear box top cover; the brackets are held to the latter with threaded studs.

Each hydraulic booster is fitted with bell crank 3 of welded construction connected to which are the control rods running from the column to the hydraulic booster slide valve bell cranks; the connection is achieved through links 5.

Bell cranks 4 coupled with the actuating rods of the hydraulic boosters are linked to the swashplate longitudinal and lateral control bell cranks through rods 6. Both rods are constructionally similar and differ only in length. The rods are made from thick-walled cromansil tubes.

Secured with tapered bolts to one end of each rod is a fork. The fork at the opposite end of each rod is screwed on, which permits adjustment of the rod length.

The hydraulic booster is controlled in the following way (see Fig.184).

Shifting control stick 2 causes rods 37 with spring devices to be displaced. The rods turn the hydraulic booster slide valve control bell cranks through bell cranks 54 and 56 and link 5 (see Figs 187 and 188). The fluid distributed by the slide valve causes the hydraulic booster rod to move, thus turning hydraulic booster bell crank 4 about its attachment bolt 7 and displacing swashplate control rod 6. The hydraulic booster cylinder will, in this case, swing with respect to the axis of trunnion 8.

The hydraulic booster construction and principle of operation will be given further below under "Hydraulic System".

FOOT CONTROL SYSTEM

The foot control system is of the dual type and employs a compound linkage (Figs 183 and 189). The linkage from foot pedals 1 to step-up gear 46 is of the rigid construction, whereas that from drum 45 and further on is made of cables terminating in bushed roller chain 52 which is slipped over tail gear box sprocket 53.

Reliability of the control system is ensured by a double cable linkage.

The BY-33A hydraulic booster is installed right before the step-up gear.

The purpose of the step-up gear is to convert the relatively small stroke of the hydraulic booster rod into large displacements of the cable linkage (the total displacement is equal to 1030 mm). This method ensures a high degree of cable linkage rigidity with a small diameter cable used.

The tail rotor pitch is changed in the following way.

Deflecting the control pedal causes the hydraulic booster to come into operation; this done, rod 30 turns the step-up gear lever, thus making the output shaft connected to the lever and the output shaft drum turn, too. As a result of the drum motion, the cables are moved together with the chain to rotate the tail gear box sprocket. Rotation of the latter is converted by the screw pair into translational motion of the tail gear box rod, which changes the rotor blade pitch through the tail gear box hub.

Moving the left-hand pedal forward results in extension of the tail gear box rod.

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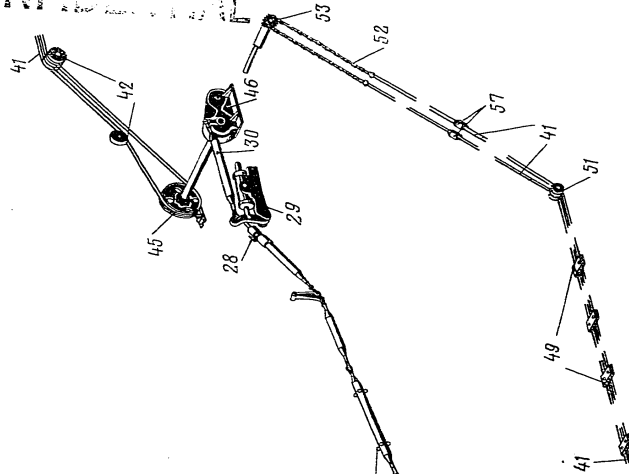
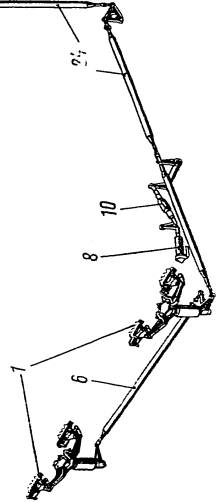


FIG. 189. FOOT CONTROL SYSTEM
 1-foot pedals; 6-pedal connecting rod; 8-MI-100M electrical actuator; 10-foot control system spring feel mechanism; 24-foot control rods; 26-pulley guides; 28-rod with spring device; 29-foot control system hydraulic booster; 30-rod from hydraulic booster to step-up gear; 41-foot control cables; 42-pulleys; 45-drum; 46-step-up gear; 49-textolite guides; 51-pulleys; 52-bushed roller chain; 53-sprocket; 57-umbuckles.



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The parallelogram type pedals (Figs 190 and 191) are made as a separate unit. The construction of the pedals permits their adjustment within a range of 120 mm to suit the pilot's height (by turning screw 8 with the help of its handwheel).

The pedal footrests carry controls 6 with limit switches designed for operating the foot control system spring feel mechanism. The setting of the controls may be adjusted by displacing the bolt in the slot machined in bracket 7.

Steel shaft 10 is mounted on cast bracket 9 to run in two ball bearings. Secured to the upper end of the shaft by tapered bolts is bracket 2, the shaft lower end carrying splined bell crank 12 that receives the control cables.

Hinged to bracket 2 are angular levers 1 connected to whose ends are footrests 3 free to turn in two ball bearings. The other ends of the levers mount inserts with threaded holes for adjusting screws with handwheels.

Two rods 4 serve to ensure parallel movement of the pedals. The rods are hinged to the studs of the base and to footrests.

Deflection of the pedals is limited by bolts 5 installed on the pedal bracket. The pedals can be fixed in the neutral position with the aid of a locating pin slipped through hollow bolt 14 and the hole made in bracket 9.

The rods from the pedals are passed on the left-hand side under the pilots' cabin floor (see Figs 183 and 189). In the cargo compartment the rods are led parallel to the lateral control rods up to the bell crank on frame No.14. At frame No.14, rod 28 is brought into the gear box compartment to be connected to hydraulic booster 29.

The EV-33A hydraulic booster (Fig.192) and step-up gear 5 are mounted on a common magnesium alloy beam located between fuselage frames Nos 15 and 17.

Hydraulic booster actuating bell crank 1 is connected with step-up gear lever 4 by welded rod 3 made from 30XICA steel and adjustable in length.

The hydraulic booster and step-up gear are secured in place by studs and bolts, the nuts being tightened up with a torque-indicating wrench.

The step-up gear output shaft is splined to the drum shaft (Fig.193). Drum 2 is manufactured from aluminum alloy and fixed to its shaft by bolts. Secured to the drum are two pair of cables running to the tail rotor.

The purpose of the step-up gear (Fig.194) is to convert the relatively small displacements of the rigid control linkage into large displacements of the cable linkage. The step-up gear has two gear drive stages with a total gear ratio of 1 : 6.68.

The gear sectors and gears are mounted in roller and ball bearings in case 2 cast of magnesium alloy. The case is provided with cover 4. Gear sector 1 has an elongated shaft one end of which is brought out of the case to receive steel lever 8 connected to the hydraulic booster rod.

Second stage gear sector 5 is press-fitted on, and fixed with locating pins to, the shaft of gear sector 3. The shaft of gear 6 is brought beyond the case to be splined to the drum shaft. The teeth of the gear sectors are polished. The gear pairs and bearings are lubricated with LITATIM-20I grease. The shaft outlets are sealed with reinforced collars.

The case is provided with threaded holes fitted with plugs 9. The holes serve to fill the case with oil when necessary and to check the oil level.

During the step-up gear assembly the lever turning angle is adjusted within $\pm 45^\circ$ with respect to the middle position. To limit the lever turning angle, use is made of bolts 7 against which gear sector 1 rests when in the extreme positions. The adjustment over, the bolts are locked and sealed.

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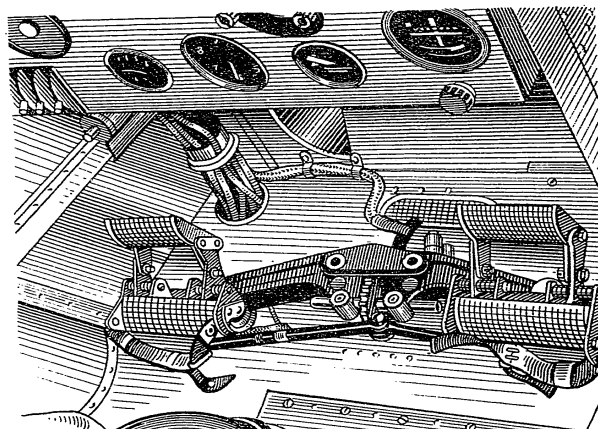


FIG. 190. FOOT CONTROL PEDALS
(view from cabin).

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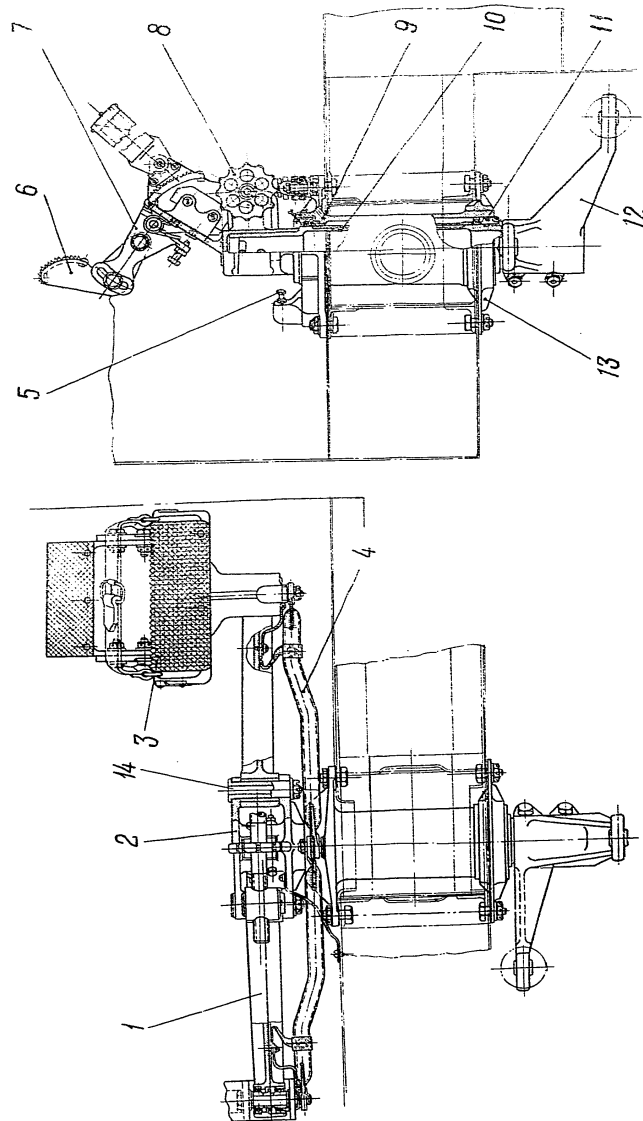


FIG. 191. FOOT CONTROL PEDALS
 1—angular lever; 2—bracket; 3—footrest; 4—rod; 5—limiting bolt; 6—spring feel mechanism control; 7—spring feel mechanism control bracket; 8—screw with handwheel; 9—pedal bracket; 10—shaft; 11—felt seal; 12—bell crank; 13—lower flange; 14—hol-
 low bolt.

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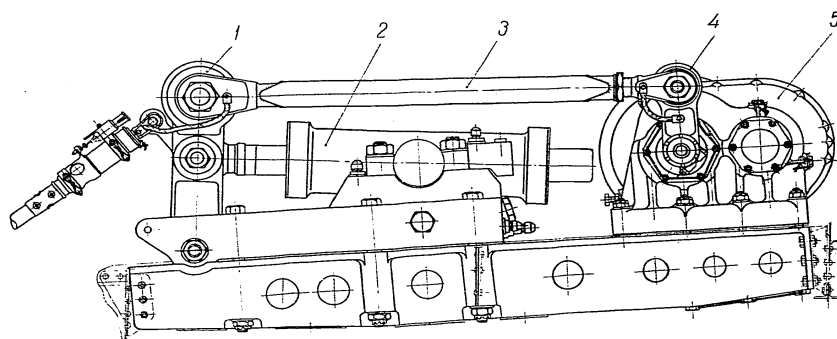


FIG. 192. MOUNTING HYDRAULIC BOOSTER WITH STEP-UP GEAR
1-hydraulic booster bell crank; 2-hydraulic booster BY-33A ; 3-rod; 4-step-up gear lever; 5-step-up gear.

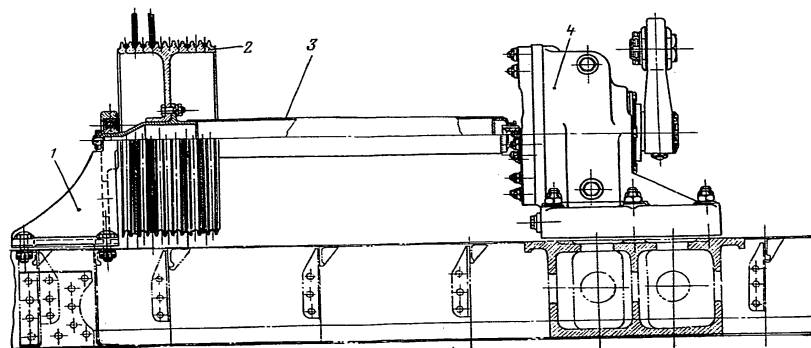


FIG. 193. INSTALLATION OF DRUM
1-bracket; 2-drum; 3-shaft; 4-step-up gear.

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SPRING FEEL MECHANISMS AND THEIR CONTROLS

The adjustable spring feel mechanisms of the longitudinal, lateral, and directional control systems serve to create a positive effort gradient on the control stick and foot pedals, as well as to unload the control stick and pedals under stable flying conditions.

The principle of installation of the adjustable spring feel mechanisms is identical for the hand and foot control systems (see Fig.183). Each spring feel mechanism unit comprises spring feel mechanism proper connected to the control line on one end, and to the MII-100M electrical actuator, on the other. The electrical actuator body is secured to the bracket mounted on the cabin floor framework.

The spring feel mechanisms are located under the pilots' cabin floor as follows: the longitudinal control mechanism is arranged to the right, and the lateral and directional control mechanisms, to the left. Access to the above mechanisms is ensured through the detachable floor panel in the middle of the cabin and the hatch located under the pilot's seat.

The electrical actuators of the hand control system spring feel mechanisms are controlled with the aid of eight-position spring-opened selector switches mounted in the top portions of the control sticks (see Fig.186).

The electrical actuators are controlled either from the left-hand or from the right-hand control stick; the transfer of control is effected by operating a throw-over selector switch mounted on the instrument panel.

The eight-position selector switch permits the following variations in switching on both electrical actuators and, hence, in unloading the control sticks:

1. Switching on of each electrical actuator separately for extension and retraction of the rod to ensure unloading the control stick in the longitudinal and lateral directions.

2. Switching on of both electrical actuators at a time, i.e. making the rods of both actuators retract or extend simultaneously, which permits the pilot to unload the control stick in both the lateral and longitudinal directions by one push given to the switch.

The electrical actuator of the directional control system spring feel mechanism is operated by pushing the controls, mounted on the pedal footrests, with the feet. The electrical actuator is connected in such a way that it does not operate when both controls are accidentally pressed at a time (the actuator circuitry is described in Book IV).

Adjustment of the efforts on the control stick consists in that the MII-100M electrical actuator causes the spring feel mechanism to be displaced axially, thus shifting the load characteristics of the spring feel mechanism in this or that direction relative to the neutral position of the control stick (pedals).

To check the position of the spring feel mechanisms, the instrument panel mounts type VIIY indicators. The transmitters of these indicators are installed on the floor framework, their carriers being connected through rods with the intermediate bell cranks which are, in turn, connected with the rods of the electrical actuators.

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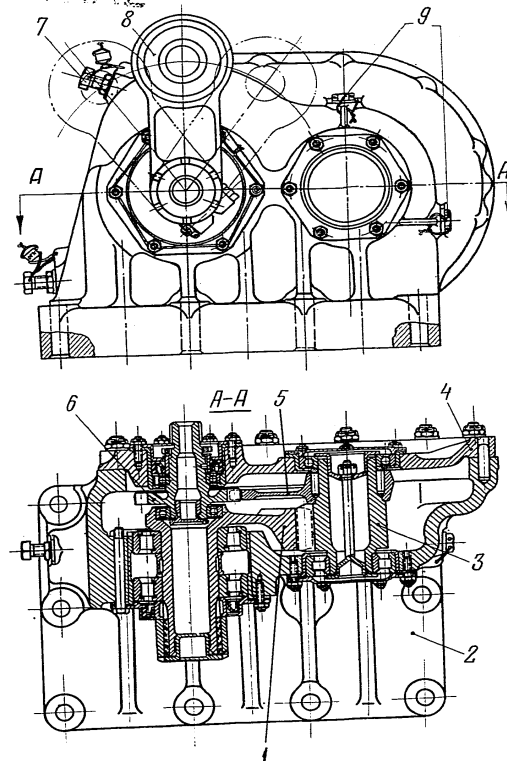


FIG. 194. STEP-UP GEAR
1-gear sector; 2-case; 3-gear sector; 4-case cover; 5-gear sector; 6-gear; 7-limiting bolt; 8-lever; 9-plugs.

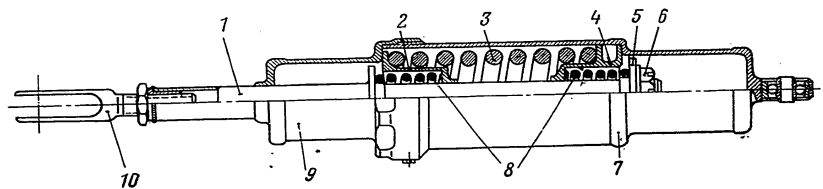


FIG. 195. HAND CONTROL SYSTEM SPRING FEEL MECHANISM
1-rod; 2-bushing; 3-main spring; 4-bushing; 5-flange; 6-nut; 7-cylinder; 8-smaller springs; 9-cover; 10-fork.

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SPRING FEEL MECHANISM

The longitudinal and lateral control system spring feel mechanisms are similar in construction (Fig.195), differing only in their dimensions and load characteristics (Fig.196).

The eye of cylinder 7 (Fig.195) serves to receive the intermediate bell crank connected with the MI-100M electrical actuator, whereas fork 10 is used for attachment of the mechanism to the hand control system linkage.

The set of springs comprises main spring 3 and two smaller springs 8 which are more rigid than the main one. All the springs are preloaded before being installed in place but the compression of the main spring is relatively higher than that of the smaller springs.

As rod 1 is displaced in either direction with respect to the cylinder, one of the smaller springs gets compressed, the load being removed from the other smaller spring until it is completely relieved of the preliminary compression. As the smaller spring is compressed to a tension value equal to that of the main spring precompression, it begins to operate together with the main spring up to the moment the rod shoulder or flange 5 rests against bushing 2 or 4; after this has occurred, only the main spring continues to operate.

The springs have been so selected as to increase the effort gradient on the control stick when close to the neutral position, due to which there is no feeling of friction in the control system, and centring of the control stick is improved.

To simplify the construction of the foot control system spring feel mechanism (Fig.197), it comprises one spring only which is mounted in the body of the mechanism with a slight precompression. The load characteristic curves of this mechanism are presented in Fig.198.

ELECTRICAL ACTUATOR

The MI-100M electrical actuator (Fig.199) comprises the following main components: electromotor μ -4TA, a planetary reduction gear unit, a roller screw pair, a limit switch unit, and a small-size plug connector.

Basic Specifications

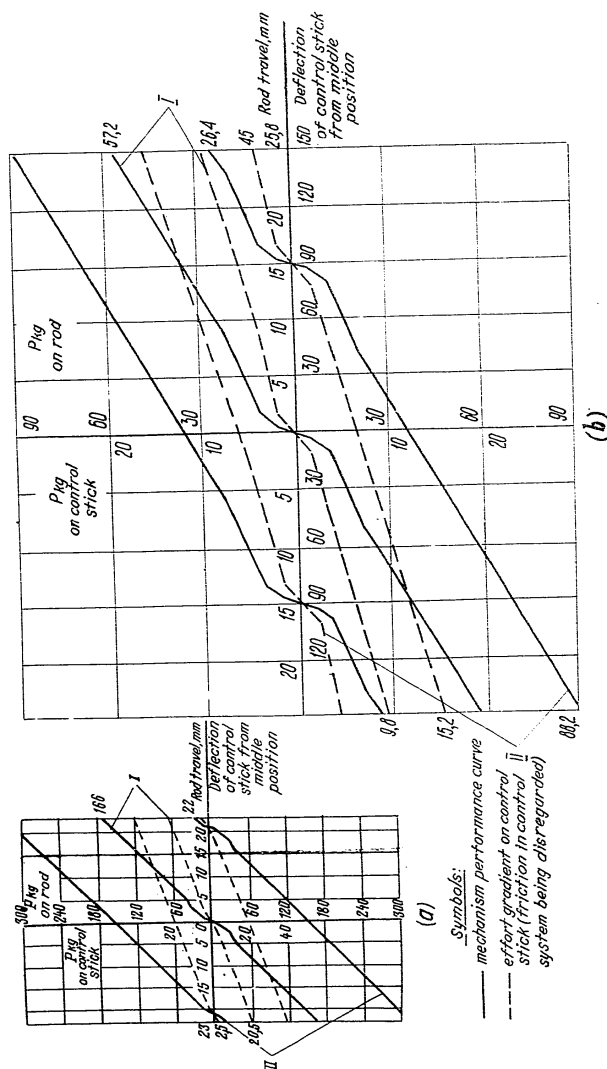
Supply voltage	27 V $\pm$ 10%
Load on rod	100 kg
Rod working stroke :	
(a) directional and lateral control systems	30 $\pm$ 1.5 mm
(b) longitudinal control system	35 $\pm$ 1.5 mm
Speed of rod travel	2.7 mm/sec $\pm$ 15%
Current drain	2 A, max.
Operational duty	intermittent

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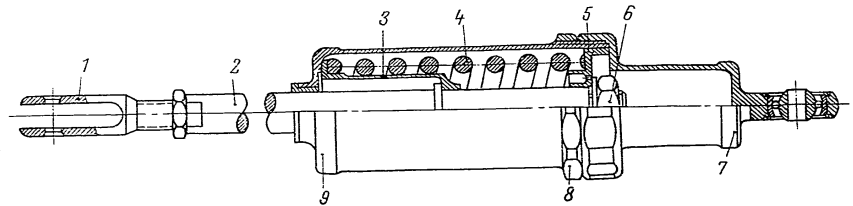


FIG. 197. FOOT CONTROL SYSTEM SPRING FEEL MECHANISM
1—fork; 2—rod; 3 and 5—sliding bushings; 4—spring; 6—nut; 7—cover with eye; 8—locking nut; 9—cylinder.

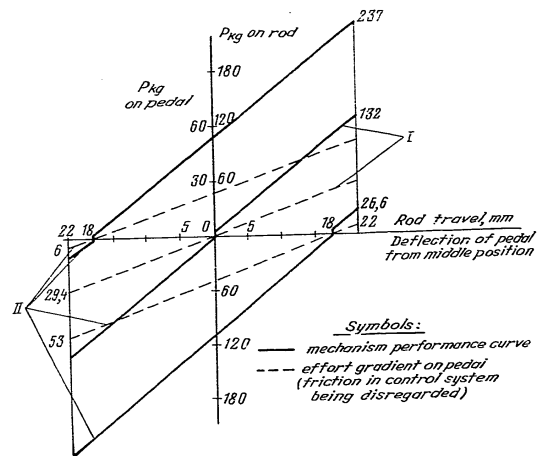


FIG. 198. LOAD CHARACTERISTIC CURVES OF FOOT CONTROL SYSTEM SPRING FEEL MECHANISM
I—with mechanism in neutral position; II—with mechanism in extreme positions.

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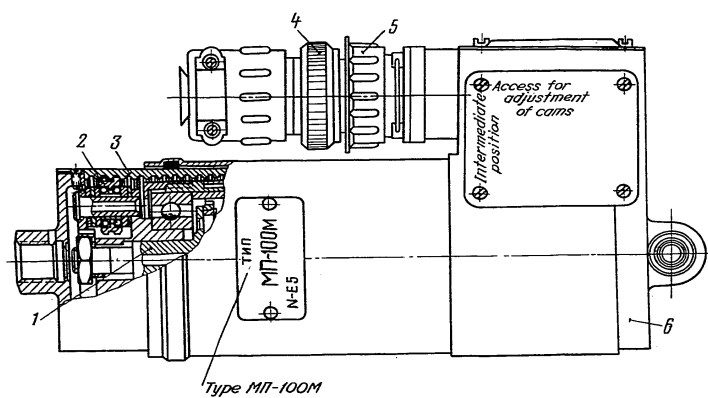


FIG. 199. ELECTRICAL ACTUATOR MI-100M
1—carriage; 2—roller; 3—rod-shaped nut; 4—straight receptacle; 5—plug MB-11;
6—body.

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Rod axial play at alternating sign load
of 5 kg:

- (a) for new mechanism 0.35 mm, max.
- (b) after end of mechanism service life 0.45 mm, max.

Weight 1.7 kg, max.

The mechanism motor is a series D.C. reversing machine. A braking clutch is fitted in the motor to slow down the reduction gear unit when voltage supply is switched off. The motor is reversed by changing polarity retaining at the same time the direction of current in the armature winding. The motor speed is 10,500 r.p.m.

To increase the torque and reduce the speed of rotation transmitted to the carriage of the roller screw pair, the electrical actuator uses a three-stage planetary reduction gear unit. The total gear ratio $i = 175.6$.

The purpose of the roller screw pair is to convert the rotary motion of the reduction gear unit output shaft into translational motion of the rod-shaped nut. The pair comprises carriage 1 mounting three rollers 2 which rotate on shafts arranged at every 120° over the circumference and displaced by 1 mm with regard to one another in the axial direction. The rollers are meshed with the trapezoidal internal thread machined in rod-shaped nut 3. The latter is prevented from rotation by its cams entering the slots of body 6. Due to this, the nut is free to move only translationally.

The limit switch unit includes two limit switches, type KB-20, intended for breaking the motor supply circuit in the extreme positions of the rod. Besides, there is a switch for sending the rod predetermined intermediate position pulse, but this switch is not used on the helicopter. The limit switches are mounted in a casing protected with a detachable cover that serves for adjusting the amount of rod extension.

SPRING FEEL MECHANISM SELECTOR SWITCH

The spring feel mechanisms are controlled with the aid of eight-position spring-opened selector switches intended for repeated short-time cut-ins of the two MIL-100M electrical actuators incorporated in the hand control system.

The selector switches are installed on the control sticks so that they can be operated without having to remove the hand from the control stick.

Basic Specifications

- Supply voltage 27 V $\pm 10\%$
- Current drain 0.3 A, max.
- Operational duty intermittent
- Weight 55 gr, max.

The switch (Fig.200) consists of a body with a lever, a base with contacts, a contact disc, a spring, and a pusher. Body 3 is manufactured from steel to house lever 4 with cap, which is mounted on ball hinge 2. The lever can be displaced in any direction from the vertical position by $18^\circ - 1.5^\circ$.

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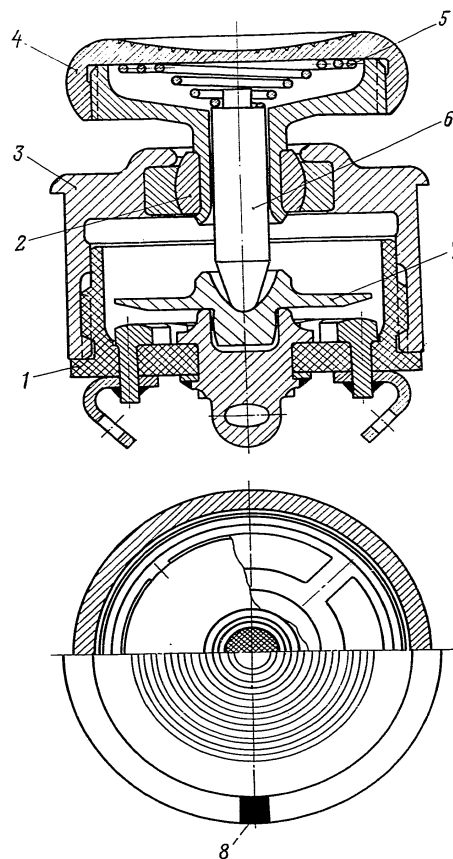


FIG. 200. SPRING FEEL MECHANISM
SELECTOR SWITCH
1—base with contacts; 2—ball hinge; 3—body;
4—lever with cap; 5—spring; 6—pusher;
7—contact disc; 8—red notch.

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The lower portion of the body is machined with internal thread for the attachment of base 1 with the contacts. Cap 4 is screwed onto the lever to tighten up spring 5 of pusher 6. Base 1 is machined from electrical textolite bar and serves for carrying the brass contacts (the central one and four contacts located on the circumference). On the outer side of the base, the contacts are fitted with terminals for soldering wires to them.

Contact disc 7 is machined from brass. Made in the disc centre is a recess for the pusher to slide in. The disc is kept on the central contact by means of its projection. The contacts, the terminals, and the disc are silver-plated. Spring 5 serves to press the pusher to the surface of the disc recess. Pusher 6 is made from electrical textolite bar; its surface is polished.

Pushing the selector switch lever to some side results in deflection of the pusher which slides over the surface of the disc recess, passes the disc supporting point on the central contact, and deflects the disc until the latter touches the contacts located over the circumference. The lever is returned into the neutral position by the force of the spring, the resultant of which is applied to the pusher, being always directed towards the disc centre.

The base is screwed into the body with the use of carbinol glue and must not be removed while in service. The body is marked with the numbers of the terminals ("1", "2", "3", and "5"); the central contact (No.4) is not marked.

Engraved opposite terminal No.3 on the upper part of the body is notch 8 which is flooded with red enamel. As the switch is mounted in place, this notch is brought into alignment with a similar notch on the helicopter control stick.

COMBINED COLLECTIVE PITCH - THROTTLE CONTROL SYSTEM

The main rotor collective pitch and the engines are controlled with the aid of common lever 4 (Fig.201) referred to as "collective pitch - throttle control". This lever is kinematically connected both to the swashplate slide and the fuel control levers located on the engines.

Shifting the collective pitch - throttle control lever upwards increases the main rotor collective pitch, simultaneously increasing the engine power rating.

To change the main rotor RPM at a given collective pitch value, use is made of a twistgrip arranged on the collective pitch - throttle control lever. The twistgrip is kinematically connected only with the fuel control levers on the pumps.

In addition to the collective pitch - throttle control system, the helicopter is furnished with an engine selector control system which permits running of each engine separately without changing the main rotor collective pitch. Engine selector control is accomplished through use of two levers 5 mounted on the common bracket of the collective pitch - throttle control lever near the pilot's seat.

The combined collective pitch - throttle control system (see Figs 183 and 201) comprises two levers 4 kinematically connected to each other with the aid of rods and a shaft, a rigid collective pitch control linkage incorporating hydraulic booster 33, a rigid engine control linkage, and two engine selector control levers. Rods 14 of these levers are connected into the engine control linkage through differential unit 15.

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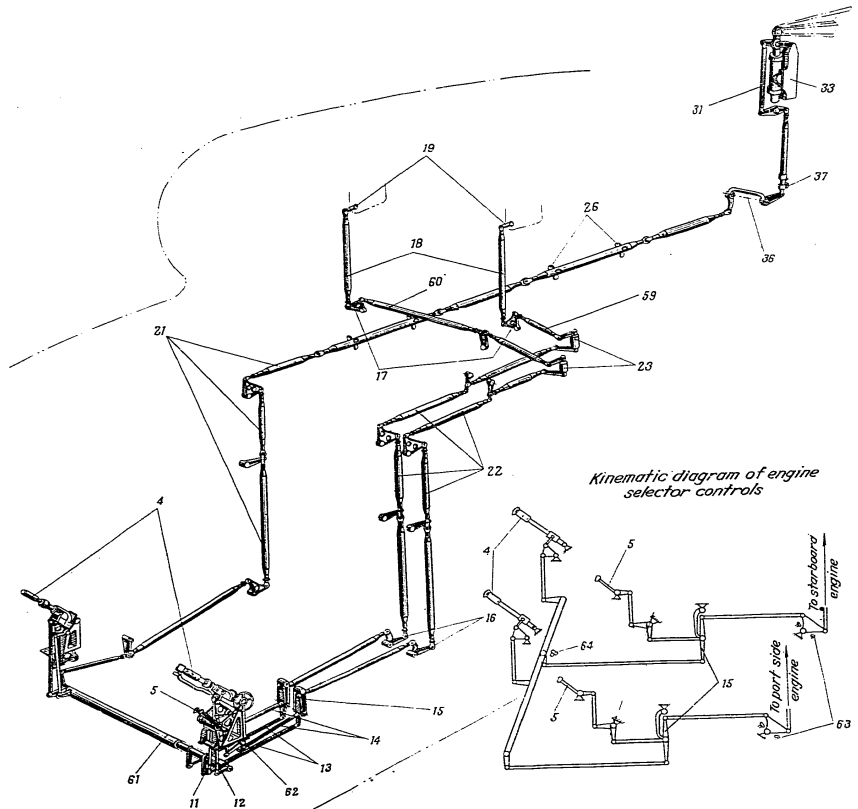


FIG. 201. SKELETON DIAGRAM OF COMBINED COLLECTIVE PITCH-THROTTLE CONTROL SYSTEM
 4—collective pitch-throttle control levers; 5—engine selector controls; 11—collective pitch control rod; 12 and 13—engine control rods; 14—engine control rods running from levers; 15—differential unit; 16—bell cranks with adjustable stops; 17—bell cranks of engine control rods; 18, 59, and 60—engine control rods; 19—control levers of HP-23 engine pumps; 21—collective pitch control rods; 22—engine control rods; 23—engine control bell crank unit; 26—pulley guides; 31—rod; 33—collective pitch control hydraulic booster; 36—bell crank; 37—rod with spring device; 61—interconnecting shaft; 62—engine selector control shaft; 63 and 64—adjustable stops.

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INSTALLATION OF COLLECTIVE PITCH THROTTLE CONTROL LEVERS AND INTERCONNECTING SHAFT

The collective pitch - throttle control levers (see Figs 183 and 201) are installed in brackets mounted on the cabin floor to the left of each pilot's seat. The shaft interconnecting both levers is located under the floor; it is connected to the levers with four rods, two of which (Ref. No.11) are designed for collective pitch control, and two (Ref. No.12), for engine control.

The left-hand (pilot's) collective pitch-throttle control lever is mounted on the bracket together with the engine selector controls and is made as a separate unit (see Fig.202).

The collective pitch - throttle control lever is mounted on axle 15. Located in the upper part of the lever are the following: friction clutch disengaging button 8, cargo tactical release button 29, and cargo emergency release button 30. Buttons 29 and 30 are provided with safety devices. The buttons are secured in body 31 whose lower part is attached to the lever with the help of a collar, whereas the upper part is articulated to the twistgrip. Thus, with the twistgrip turned, the body with the buttons remains motionless. A disc friction clutch fitted with electro-hydraulic control reliably retains the collective pitch - throttle control lever in any position, which ensures stepless setting of the main rotor collective pitch.

The friction clutch is normally tightened by handwheel 21 so that the collective pitch - throttle control lever can be displaced only when an effort of 20 to 25 kg is applied to it. The friction clutch is switched off by depressing button 8 located in the upper part of the lever. The button depressed, the solenoid-controlled slide valve of the hydraulic system goes in operation and the hydraulic fluid pressure causes piston 17 to be displaced. Piston 17 presses off plate 18 and releases the discs of the friction clutch. As the pilot's finger is removed from the button, the pressure in the chamber before the piston drops down, and the eight return springs cause the plate to press the friction clutch discs together once again.

The operating angle of the collective pitch - throttle control lever is equal to 46°30'. In the extreme positions the lever is retained by stops 23 located on the bracket. It is possible to adjust the extreme positions of the lever with the aid of screws 22 installed in the projection of the lever base.

The collective pitch control rod is connected to lever body lug 7 which is fitted with a ball bearing. Twistgrip 9 along with its shank is carried in two ball bearings in the lever body. Arranged on the splines of the shank end is carrier 1 which is provided with a hinged lug receiving engine control link 13.

The motion, originating when the collective pitch - throttle control lever or the twistgrip is displaced, is transmitted to bell crank 6 and the interconnecting shaft lever (through a rod). The full turning angle of the twistgrip is 100°. This angle is limited by two screws 11 arranged on the lever body.

The twistgrip is fitted with friction discs; the degree of disc tightening is adjusted by clutch 10.

Both engine selector control levers are mounted on a common axle. One lever is rigidly connected with shaft 25, and the other, installed on the same shaft in two ball bearings. Levers 28 mounted on the shaft and sleeve of the latter lever are intended for the connection of rods. Both control levers are provided with friction clutches 26 and 27 which create the required effort on the lever.

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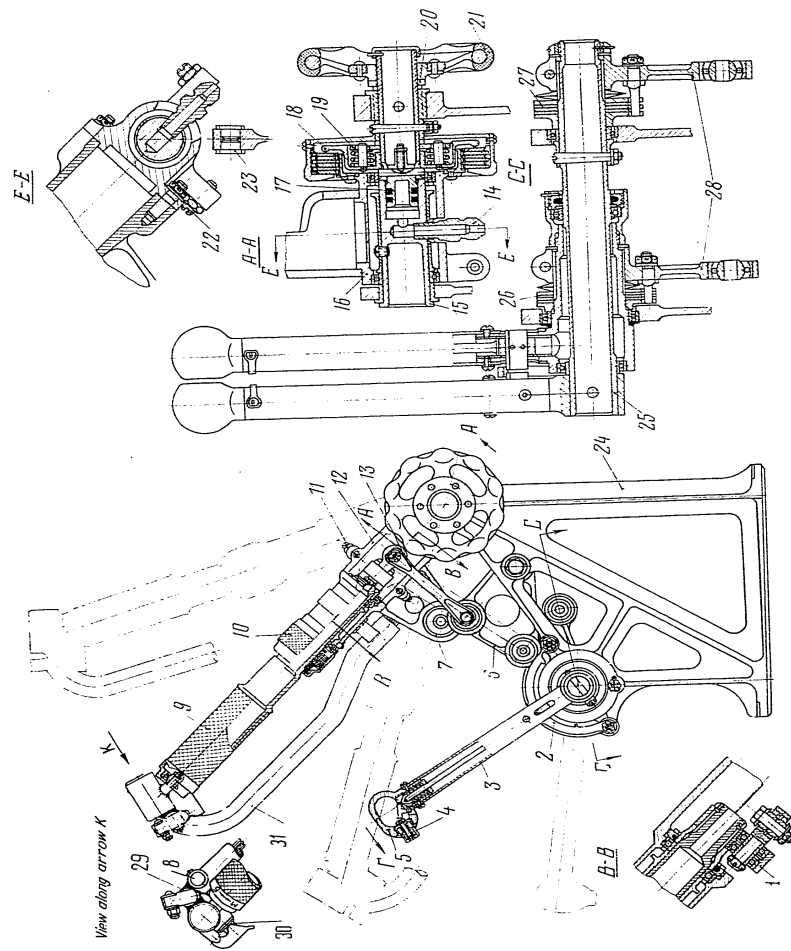


FIG. 202. LEFT-HAND COLLECTIVE PITCH-THROTTLE CONTROL LEVER
 1—carrier; 2—serrated plate; 3—engine selector control lever; 4—retainer
 button; 5—knob; 6—bell crank; 7—body; 8—friction clutch disengaging
 button; 9—twistgrip; 10—friction clutch; 11—limiting screw; 12—body;
 13—link; 14—pipe union; 15—axle; 16—control lever base; 17—piston;
 18—plate; 19—thrust disc; 20—bushing; 21—handwheel; 22—limiting screw;
 23—stop; 24—bracket; 25—lever shaft; 26 and 27—friction clutches of
 levers; 28—levers; 29—cargo release button; 30—emergency cargo release
 button; 31—body.

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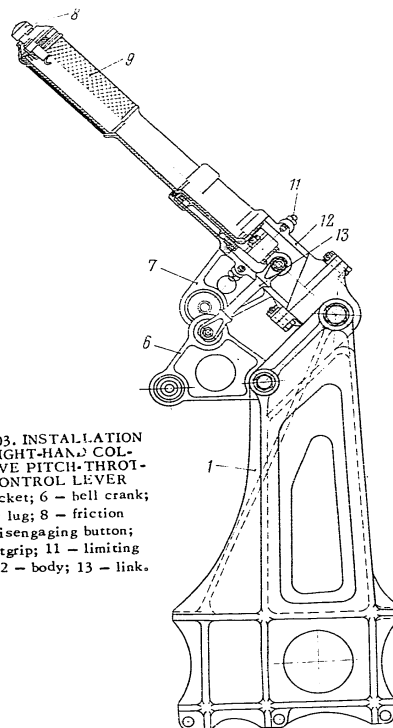


FIG. 203. INSTALLATION OF RIGHT-HAND COLLECTIVE PITCH-THROTTLE CONTROL LEVER
1 - bracket; 6 - bell crank;
7 - body lug; 8 - friction clutch disengaging button;
9 - twistgrip; 11 - limiting screw; 12 - body; 13 - link.

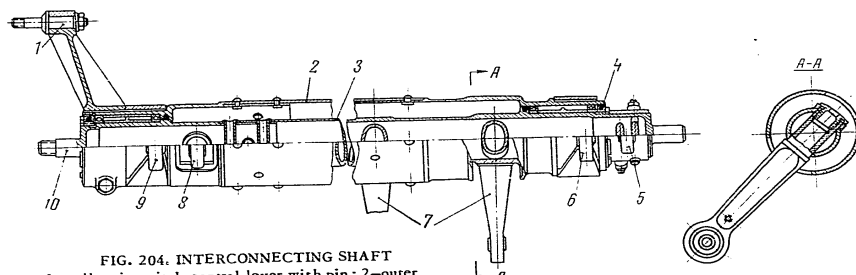


FIG. 204. INTERCONNECTING SHAFT
1 - collective pitch control lever with pin; 2 - outer shaft; 3 - inner shaft; 4 - felt seal; 5, 7, and 8 - engine control levers; 6 and 9 - collective pitch control levers; 10 - trunnion.

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The levers are fixed in position by a tooth which enters the space in serrated plate 2 and are released by pushing button 4. Shifting the lever as far upward as it will go sets the engine to nominal rating; depressing the lever will decrease the fuel supply to the engine.

The right-hand (co-pilot's) collective pitch - throttle control lever is, essentially, similar in construction to the pilot's lever (see Fig.203), differing from the latter only in that it has no friction devices, engine selector control levers, or cargo tactical and emergency release buttons.

The lever interconnecting shaft (Fig.204) comprises two shafts, each of which is free to rotate independently of the other. Inner shaft 3 with trunnions 10 on its faces interconnects the engine control linkage. The shaft trunnions are secured in brackets fitted with ball bearings; the brackets are located under the pilot's cabin floor. Outer shaft 2 interconnects the collective pitch control linkage. All the levers are rigidly fixed to the shafts.

Levers 6 and 9 serve for connection of the collective pitch control rods running from the collective pitch - throttle control levers. From lever 1 with pin, the collective pitch control linkage is led to the hydraulic booster.

Connected to levers 5 and 8 are the engine control rods running from the collective pitch - throttle control levers. The control linkage from levers 7 is led to the differential unit and, further on, to the fuel supply levers mounted on the engines.

COLLECTIVE PITCH CONTROL LINKAGE

From the interconnecting shaft lever, collective pitch control linkage 21 (Figs 183 and 201) runs in parallel with the longitudinal control linkage. The linkage comprising control rods and bell cranks is passed under the cabin floor to run over the web of frame No.1 in the fuselage central part. The rods running over the cargo compartment ceiling are installed in pulley guides 26. At frame No.14 the control linkage is passed from the cargo compartment into the gear box compartment to be connected to the slide valve bell crank of hydraulic booster 33.

The EV-32A hydraulic booster is installed on a bracket (Fig.205), being secured to the latter with studs. The stud nuts are tightened by a torque-indicating wrench.

Bracket 6 is made from aluminum alloy AK6. Its lower part is fastened with two bolts to attachment fittings 8 located on the gear box case. The upper part of the bracket is bolted to bracket 5 of the swashplate lever. The bracket sides are provided with bosses on which the hand control system hydraulic booster brackets rest in order to increase rigidity of the linkage.

The hydraulic booster actuating rod is connected through link 3 with swashplate lever 4 by means of self-setting roller bearings.

ENGINE CONTROL LINKAGE

The two engine control lines (Ref. No.22, Fig.183) are led from the interconnecting shaft levers beside the foot control system linkage (to the left of it). At frame No.4 the lines are brought out of the cabin to be terminated on the engine levers.

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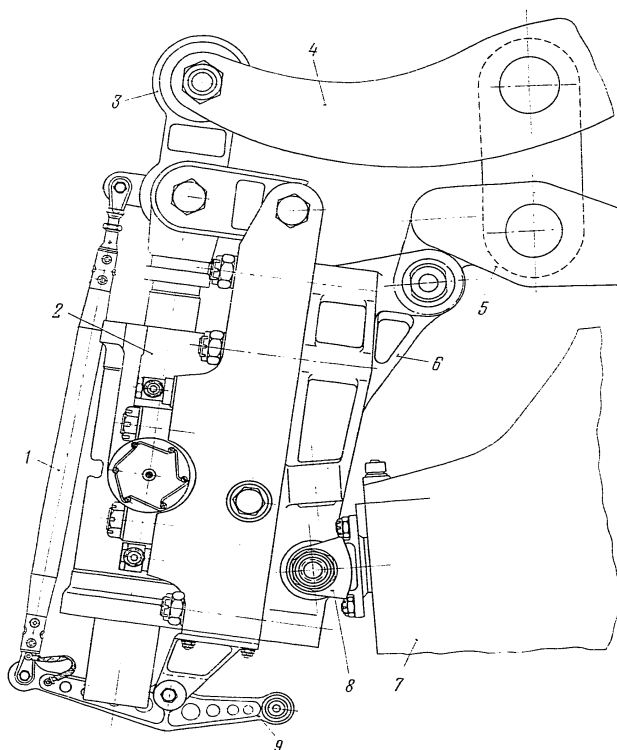


FIG. 205. INSTALLATION OF HYDRAULIC BOOSTER
1—rod; 2—hydraulic booster BV-32A; 3—hydraulic booster link; 4—swashplate lever; 5—lever bracket; 6—bracket; 7—gear box case; 8—bracket attachment fitting; 9—bell crank.

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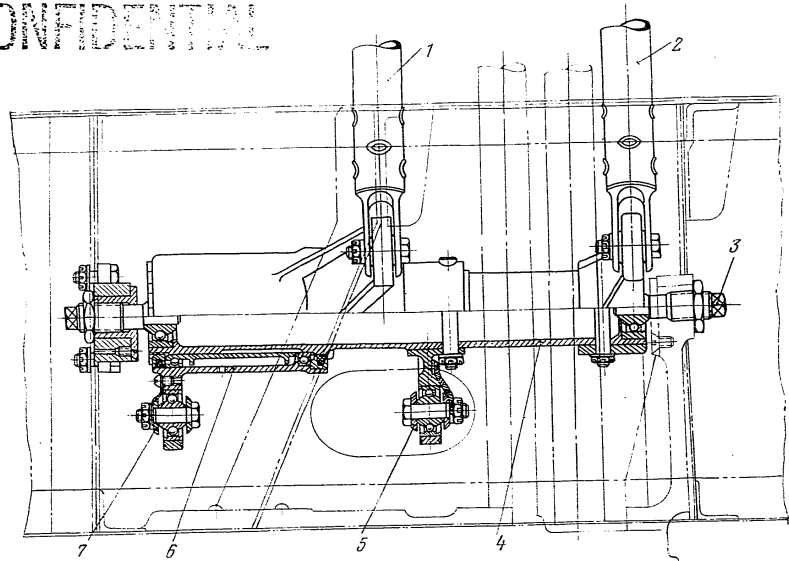


FIG. 206. ENGINE SELECTOR CONTROL SHAFT

1 and 2—rods running from engine selector control levers; 3—axle; 4—inner shaft; 5 and 7—rods running to differential unit; 6—bell crank.

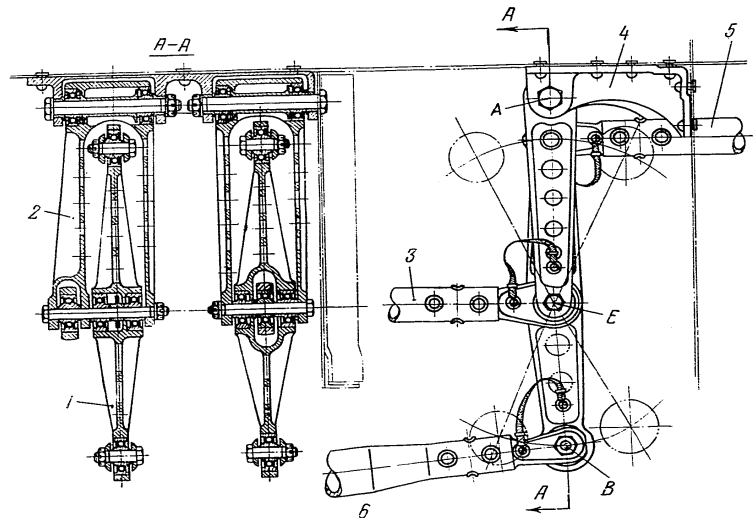


FIG. 207. DIFFERENTIAL UNIT

1 and 2—bell cranks; 3—two rods led from engine selector control levers; 4—bracket; 5—two rods running to engines; 6—two rods led from collective pitch-throttle control lever.

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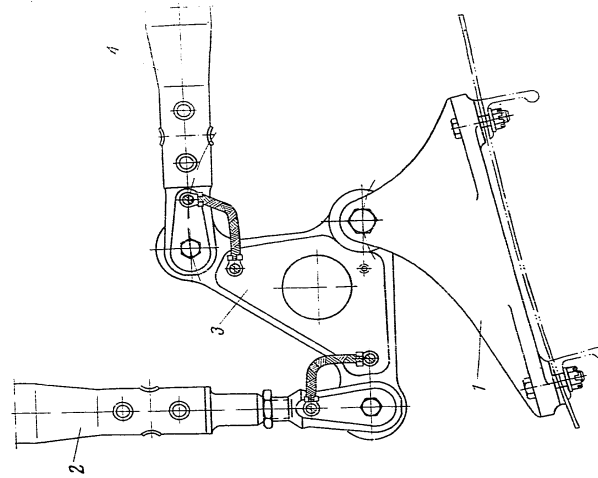


FIG. 209. STARBOARD ENGINE CONTROL UNIT.
1-bracket; 2-rod connected with lever on engine; 3-bell crank; 4-control rod led from collective pitch-throttle control lever.

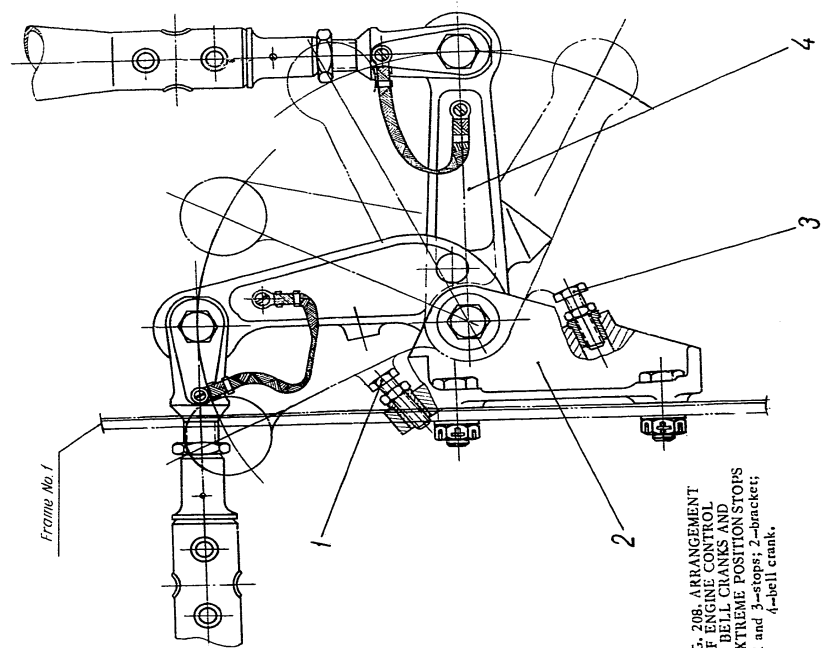


FIG. 208. ARRANGEMENT OF ENGINE CONTROL OF BELL CRANKS AND EXTREME POSITION STOPS.
1 and 3-stops; 2-bracket; 4-bell crank.

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Arranged under the cabin floor is differential unit 15 connected to which are two rods 13 running from the collective pitch - throttle control lever interconnecting shaft and two rods 14 led from the engine selector control shaft levers. The engine selector control shaft is located under the cabin floor, too. The two levers of this shaft are connected through rods with engine selector control levers 5.

The construction of the shaft is presented in Fig.206. Inner shaft 4 along with the ball bearings pressed into the shaft faces is secured in brackets on axles 3. The two levers are fastened to the shaft with tapered bolts. Bell crank 6 with its two levers is mounted in two open ball bearings provided with felt seals.

The motion from the engine control levers is transmitted to the shaft by rods 1 and 2, and from the shaft to the differential unit, by rods 5 and 7.

The differential unit (Fig.207) comprises two pairs of bell cranks hinged to each other. Bell cranks 2 are fastened to bracket 4. In Fig.207 bell cranks 2 are shown in a position at which the levers are fixed in the spaces of the serrated plates (see Fig.202). In this case, the motion from the collective pitch - throttle control lever is transmitted through rod 6 (see Fig.207) and bell cranks 1 to rods 5 running to the engines. Bell cranks 1 turn about fixed axle B.

The motion, originating when the engine selector control levers are displaced, is imparted to rods 3; this being the case, bell cranks 2 move relative to axle A, whereas bell cranks 1 turn about axle C which is now motionless. As a result, the motion is again transmitted to rods 5 running to the engines.

Due to the fact that the summary displacements (originated by the collective pitch - throttle control lever and the twistgrip) of the control linkage exceed the engine control lever stroke, provision is made for adjustable extreme position stops of the bell cranks. These stops are installed in the lower part of the bell crank unit near frame No.1 of the fuselage central part (the arrangement of the stops is shown in Fig.208).

The stops have been so adjusted that the bell crank rests against one of the stops when the collective pitch - throttle control lever is moved to the extreme lower position and the twistgrip is in the middle position with regard to its stops; this corresponds to 15 to 18° by the fuel control lever position indicator dial. In this case, the engine selector control levers are fixed in the spaces of the serrated plate.

The bell crank is brought to rest against the other stop when the collective pitch - throttle control lever is shifted by 28 to 32° upward from the lower position, and the twistgrip is turned as far to the right as it will go; this position corresponds to a collective pitch of 9° by the rotor pitch indicator and to 96 to 100° by the fuel control lever position indicator dial.

In addition to the above stops, the engine control linkage is provided with idle rating adjustable stop 64 (see Fig.201). The stop is located on the left-hand side under the pilots' cabin floor and comprises a bracket and a bolt which is screwed into the bracket and held there by a locking nut. In the idle rating position the bolt head restricts the travel of lever 7 (see Fig.204) to prevent it from passing over the "dead position".

Two similar engine control units are mounted on the ceiling of the fuselage central part in the vicinity of frame No.4 (the starboard engine control unit is shown in Fig.209).

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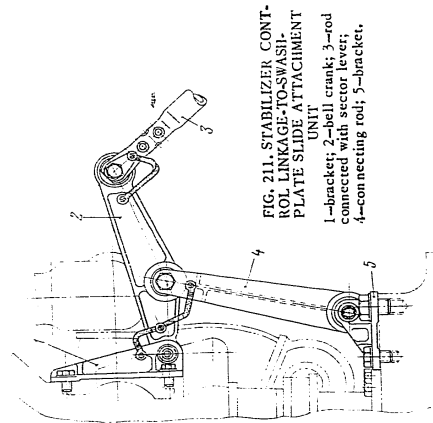


FIG. 211. STABILIZER CONTROL LINKAGE-TO-SWASH-ROD ATTACHMENT
1-bracket; 2-crank; 3-sector lever; 4-connecting rod; 5-bracket.

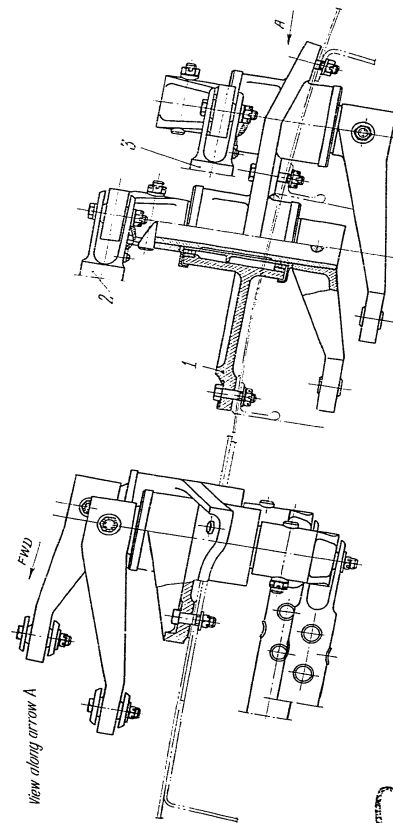


FIG. 210. ENGINE CONTROL BELL CRANK UNIT MOUNTED NEAR FRAME NO. 4
1-bracket; 2-port side engine control rod; 3-starboard engine control rod.

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For the construction of the unit located in the vicinity of frame No.4, refer to Fig.210 which shows the way the control rods are brought out of the cargo compartment through the ceiling. Mounted in the ball bearings of the bracket cast from magnesium alloy are steel axles secured to the ends of which with tapered bolts are levers for the control rods.

Convenience in engine control linkage adjustment is ensured by cuts made on the levers of the HP-23 fuel regulating pumps. These cuts make it easy to change the distance from the lever axis of rotation to the point of the rod connection.

STABILIZER CONTROL SYSTEM

The stabilizer setting angle control system is interconnected with the main rotor collective pitch controls. Thus, an increase in the collective pitch involves a simultaneous increase in the stabilizer setting angle (the stabilizer leading edge moves upward).

The stabilizer control system (Fig.183) is a composite type. Motion is transmitted from the swashplate slide to sector 43 through control rods, and from the sector to the drum of stabilizer control mechanism 48, through control cables 40. Motion of the screw of the stabilizer control mechanism is imparted to the stabilizer through rod 50.

The attachment unit connecting the control linkage to the swashplate slide (Fig.211) comprises connecting rod 4 mounted on bracket 5 and bell crank 2 secured to the connecting rod. One end of the bell crank is connected to bracket 1 rigidly fixed to the slide, and the other, to the sector setting lever (through rod 3). Bell crank 2 is coupled with bracket 1 by means of a hinged bearing; the remaining connections are made with the help of ball bearings.

Sector 3 (Fig.212) is installed on bracket 1 cast from magnesium alloy and secured on the studs of the main gear box case. Mounted on the bracket in ball bearings is steel pivot pin 4 provided with a flange on one end, and with splines, on the other. The pivot pin is held in the bracket by nut 5 locked with the aid a threaded pin.

Secured with six bolts to the pivot pin flange is sector 3 fabricated from aluminum alloy AK6. Splined to the pivot pin opposite end is lever 6 held in place by a coupling bolt and nut 7.

The cable ends fitted with cable shoes are attached to the sector ^{with shafts.} The control cables pass from the sector to the stabilizer control mechanism at the starboard of the tail part of the fuselage and the tail boom (see Fig.183).

Stabilizer control mechanism 48 (Fig.183) is arranged between frames Nos 14 and 15 of the tail boom and bolted to the plate which is riveted into the tail boom framework.

STABILIZER CONTROL MECHANISM

The construction of the stabilizer control mechanism is shown in Fig.213.

Arranged in bushings in cast body 4 with flange 7 is drum 9 whose outer surface is provided with grooves for the control cable. Fitted inside the drum on

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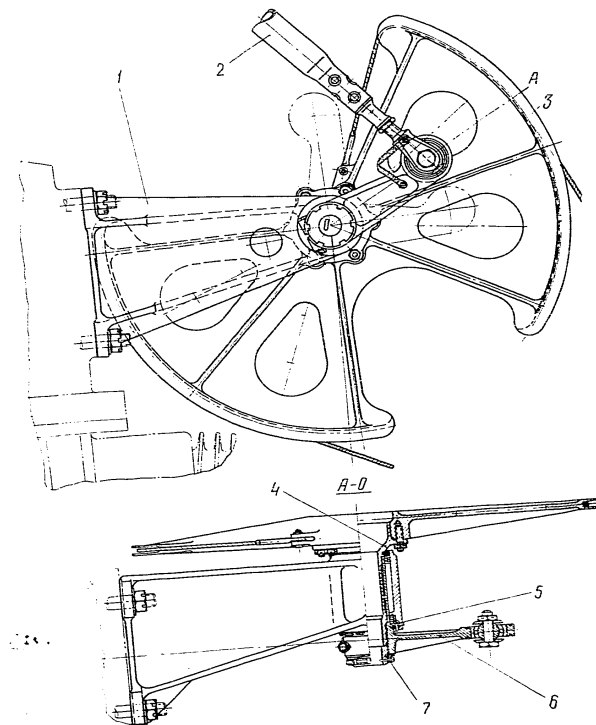


FIG. 212. INSTALLATION OF SECTOR
1—bracket; 2—rod; 3—sector; 4—pivot pin; 5—nut; 6—lever; 7—nut.

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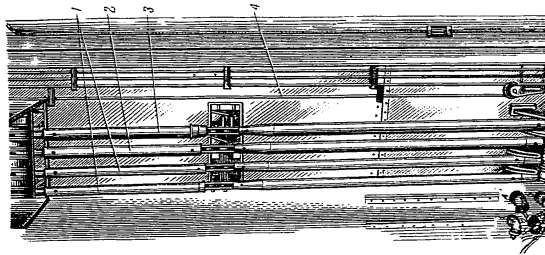


FIG. 214. CONTROL RODS AND BELL CRANKS LOCATED ON FRAME NO.1 OF LOSELAGE CENTRAL PART
(with casing removed)
1—engine control rods; 2—foot control system rods; 3—lateral control system rods; 4—transmission brake control cable.

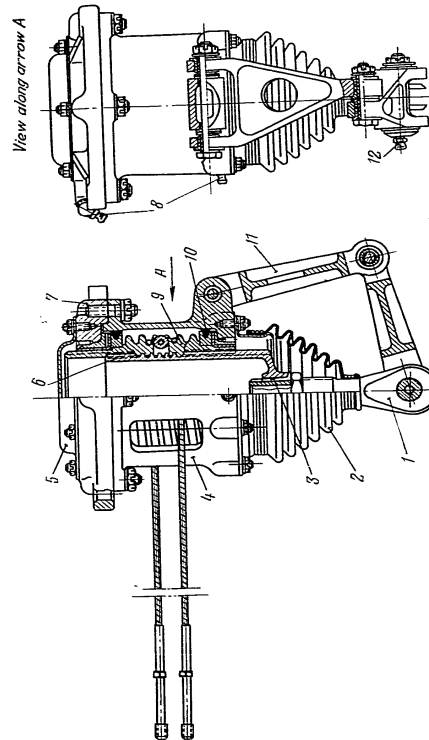


FIG. 213. STABILIZER CONTROL MECHANISM
1—fork; 2—boot; 3—key; 4—body; 5—cap; 6—screw; 7—flange; 8—grease fittings; 9—drum; 10—felt sealings; 11—torque link; 12—gear fitting.

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trapezoidal thread is screw 6 displaced axially as the drum is rotated. The screw is prevented against rotation along with the drum by torsion link 11. The shank of fork 1 is threaded into screw 6 and locked by key 3.

The friction surfaces of the bushings have grooves for supply of lubricant which is fed to them through grease fittings 8 screwed into the stabilizer control mechanism body. Felt sealing 10, boot 2, and cap 5 serve to protect the mechanism against contamination.

RIGID CONTROL LINKAGE

Rigid rods are used in the hand, foot, and collective pitch control systems. These rods are employed on the control linkage sections arranged under the pilots' cabin floor, in the plane of fuselage central part frame No.1, in the cargo compartment, and in the gear box compartment. The rods are connected into the linkage with the aid of bell cranks (see Figs 183 and 214). Between frames Nos 1 and 14 of the fuselage central part the rods move in pulley guides 26.

The entire engine control line is composed of rigid rods and bell cranks.

All the rods (with the exception of rods 30, 31, and 44 installed in the hand and foot control systems after the hydraulic boosters, as well as the rod of link 7 and rod 50) are manufactured from duralumin tubes with ends compressed to the same diameter for the installation of rod lugs.

Some of the rods are made adjustable in length due to presence of threaded lugs. The main types of the rods employed are presented in Fig.215.

Four rods 28, 34, 35, and 37 (see Fig.183) installed before each hydraulic booster are provided with special spring devices with limit switches. These rods are intended for changing the hydraulic booster fluid supply from the main hydraulic system over to the duplicating one (refer to explanations given under "Hydraulic System" further below).

The systems will be changed over in case the following efforts are applied to the control stick or the foot pedals:

Effort applied	Hydraulic system change-over effort, kg
To control stick in longitudinal control system	80 ± 10
To control stick in lateral control system	70 ± 10 20
To foot control pedal	130 ± 15
To collective pitch control lever	70 ± 10

The general view of the rod supplied with a spring device and a limit switch is presented in Fig.216. Shown in Fig.217 is the construction of the control rod spring lug. Spring ? is precompressed; the spring precompression value is so selected as to ensure that the spring does not get deformed during normal operation of the hydraulic boosters.

To change over the hydraulic systems, it is necessary to apply an effort to the fork of lug 10, which will exceed the spring precompression value. In this case, the lug will move over a distance of up to ± 3 mm, causing limit switch 3 to change the hydraulic booster fluid supply from the main hydraulic system over

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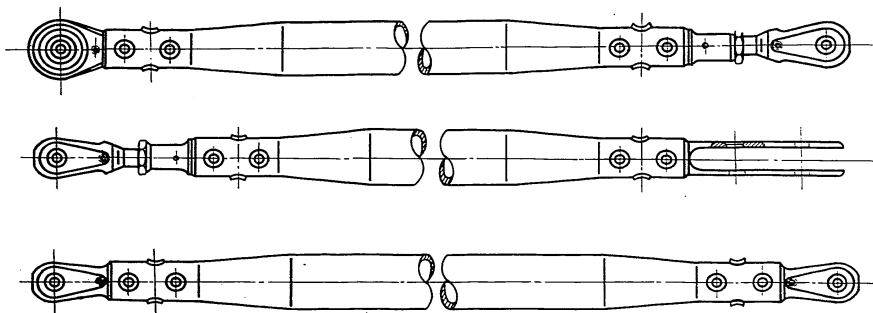


FIG. 215. MAIN ROD TYPES.

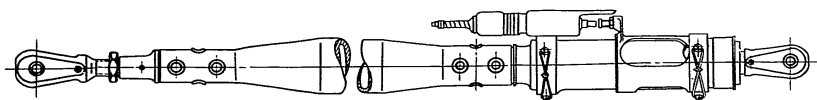


FIG. 216. ROD WITH SPRING DEVICE AND LIMIT SWITCH.

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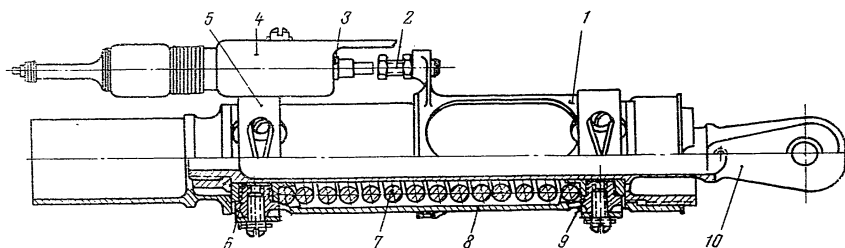


FIG. 217. SPRING LUG WITH LIMIT SWITCH
1-bracket; 2-bolt; 3-limit switch; 4-casing; 5-bracket; 6 and 9-stops; 7-spring; 8-body; 10-lug.

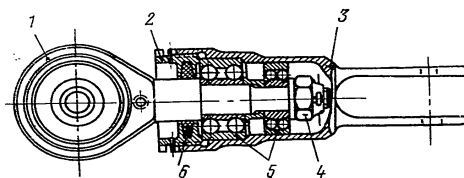


FIG. 218. LINK
1 - eye with shank; 2 - nut; 3 - fork; 4 - nut; 5 - ball bearings;
6 - felt sealing.

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to the duplicating one by means of an electrical valve. The lug travel is limited within ± 3 mm by stops 6 and 9 located in the oval slots of body 8.

When a traction load is applied to the rod, the bushing with stops 9 will be displaced; bracket 1 along with adjusting bolt 2 will move together with the bushing. As a result, bolt 2 will be pressed against the limit switch pusher.

With a compression load applied to the rod, the bushing with stops 6 will get displaced, thus causing respective displacement of bracket 5 and limit switch 3 secured to it.

The link (Fig.218) makes it possible for the lateral control rod to freely turn. This rod is located inside the control column shaft (see Fig.185). The link consists of eye 1 with shank and fork 3, all made from steel, assembled in two ball bearings 5 and braced up by nuts 2 and 4.

Spherical ball bearings with protective washers are used in the connection of the rods to bell cranks, as well as in the rod-to-rod connections on the control linkage section employing pulley guides.

All the control bell cranks, with the exception of bell cranks 27 and 36 (see Fig.183), are AK6 aluminum alloy stampings. Each bell crank is installed in two ball bearings on a bracket cast from magnesium alloy. The bell cranks are held in place with bolts machined from steel 30XICA in compliance with fine quality requirements.

Welded lateral control bell crank 27 (see Figs 183 and 184) is made from a tube. Fixed to the tube by welding, too, are two levers for the attachment of rods; welded into the faces of the tubes are sleeves with trunnions which serve for securing the bell cranks in the brackets.

The bell crank unit 36 (see Fig.183) is located at frame No.14 of the fuselage central part. The unit comprises two bell cranks: one of them is intended for the longitudinal control linkage (Ref.No.5, Fig.219), and the other, for the collective pitch control linkage (Ref. No.2).

The longitudinal control bell crank is a welded shaft with two levers 4 and 7 secured to it. The shaft trunnions are carried in ball bearings installed in bracket 1.

The collective pitch control bell crank is also of a welded construction. It has been made free to turn in ball bearings with respect to the shaft of bell crank 5.

The lower parts of bell cranks 36 and 27 (see Figs 183 and 184) are provided with holes which serve to fix the bell cranks in positions corresponding to the neutral position of the controls. Setting the controls to neutral is necessary to facilitate adjustment operations.

The bell cranks are fixed in the neutral position with the aid of locating pins. The arrangement of holes in the bell cranks and the casing is shown in Fig.219. The bell cranks of the lateral and directional control systems are fixed just in the same way.

Pulley guides 26 (see Fig.183) are arranged on frames Nos 3, 5, 7, and 9 of the fuselage central part. Pulley guides (Fig.220) for two tubes comprise bracket 1 cast of magnesium alloy and pulleys 2 pressed from crushed textolite. The pulleys rotate about standard shafts 3.

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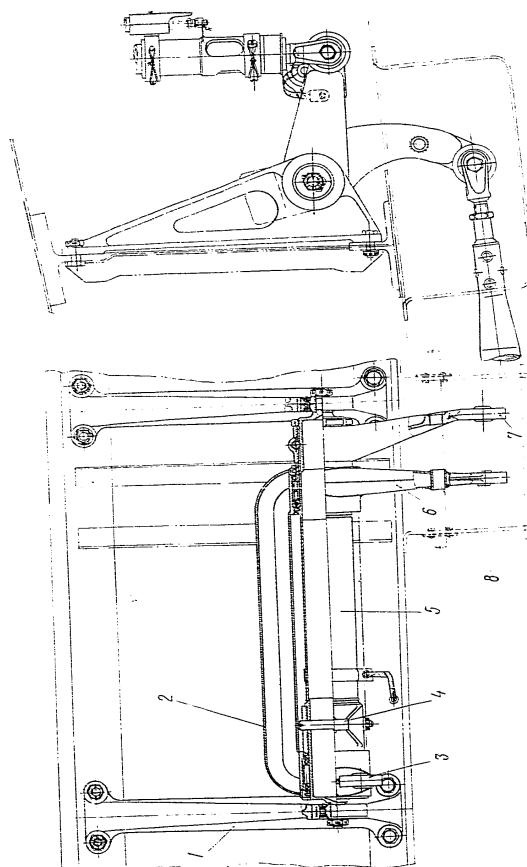


FIG. 219. LONGITUDINAL AND COLLECTIVE PITCH CONTROL BELL CRANKS
1 - bracket; 2 - collective pitch control bell crank; 3 and 6 - levers; 4 and 7 - longitudinal control bell crank;
8 - fixing holes.

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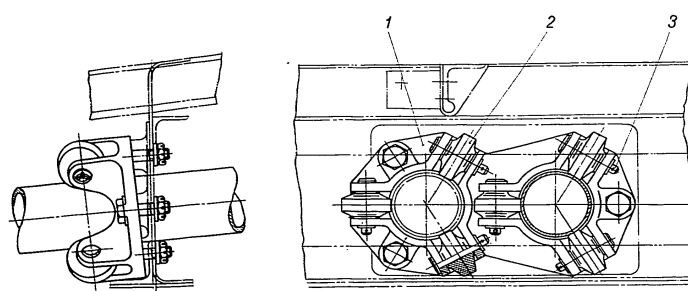


FIG.220. PULLEY GUIDES
1 - bracket; 2 - textolite pulleys; 3 - shaft.

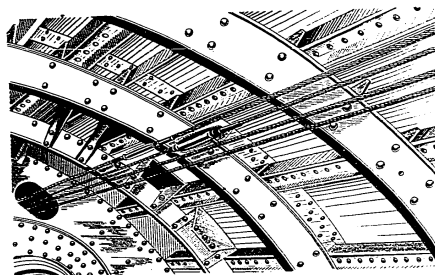


FIG.221. DIRECTIONAL (FOOT) CONTROL SYSTEM CABLES.

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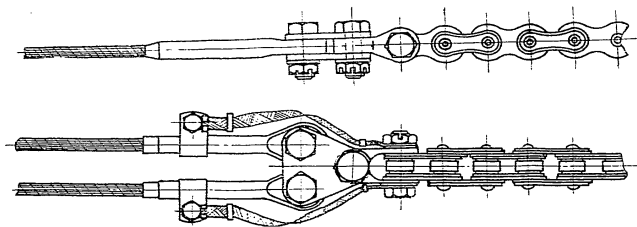


FIG.222. CABLE-TO-CHAIN CONNECTION.

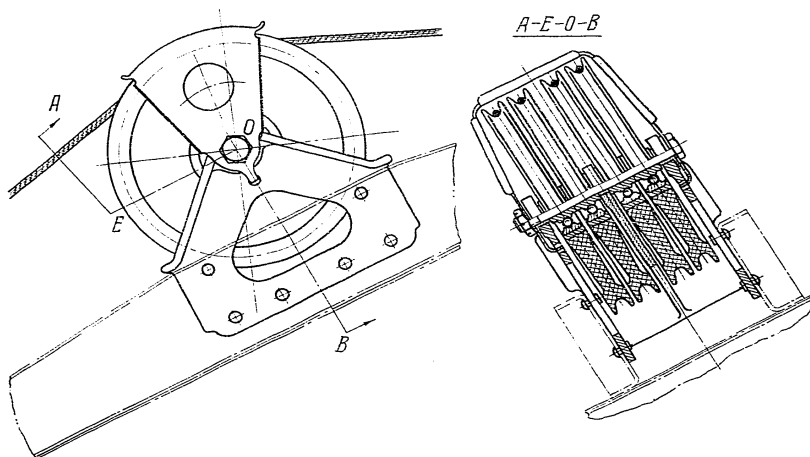


FIG.223. DIRECTIONAL CONTROL SYSTEM PULLEYS.

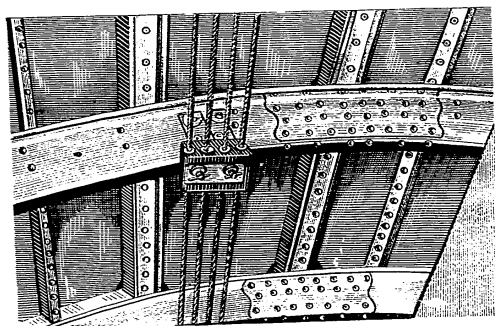


FIG.224. TEXTOLITE PULLEY GUIDES.

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CABLE CONTROL LINKAGE

Control cables are employed in the directional and stabilizer control systems in the fuselage tail part and all along the tail boom (see Fig.183).

The cables used are extra flexible type, model 7 x 19. The directional control cables are 4 mm, and the stabilizer control cables, 3 mm in diameter. Reliability of the directional control system is ensured by the use of a dual cable linkage. The cables are terminated in their shoes by compression.

The turnbuckles (Fig.221) used in the cable control linkage serve to adjust the control lines and to ensure the required cable tension. At an ambient air temperature of +15°C it is allowed to adjust the cable tension with the aid of the turnbuckles within the following ranges: 90 to 110 kg for directional control system, and 65 to 85 kg for stabilizer control system. At other ambient temperatures cable tension is corrected in accordance with special charts.

The directional control cable linkage terminates in bushed roller chain 52 (see Fig.183) which is bolted to the cable shoes with the aid of a link (Fig.222).

The cables run over textolite pulley guides fitted with pressed-in ball bearings.

The pulley guides are mounted in brackets (Fig.223) cast from magnesium alloy. To prevent the cables from coming out of the pulley grooves, use is made of special retainers.

The cables are supported on the control line rectilinear section by textolite pulley guides (see Fig.224) spaced at intervals of 2.5 to 3 m.

TRANSMISSION BRAKE CONTROL

The transmission brake (Fig.225) is controlled with the aid of handle 1 connected to brake lever 6 by cables. The transmission brake control is interlocked with the engine starting system, due to which engine starting is possible only after complete release of the transmission brake, i.e. when the brake control handle is in its lowermost position.

The brake control handle (Fig.226) is located in the pilots' cabin to the right of the pilot's seat and secured to cast bracket 11 fitted with gear sector 10. The purpose of the gear sector is to permit fixing of the handle in various positions.

The handle is locked with the aid of latch 4 which is caused by spring 5 to enter spaces formed between the sector teeth. The handle is released by depressing button 1 connected through rod 2 with the slide in which the latch is mounted. Handle pivot pin 6 is fitted on the bracket in ball bearings; the latter are ensured against contamination by felt seals. From lever 7, secured on the pivot pin, the control cable is passed to the brake lever.

The brake control and engine starting systems are interlocked by means of limit switches 8. With the brake control handle in the lowermost position, the limit switches operate to close the engine starting system electric circuit. Operation of the limit switches is adjusted with the aid of bolts 9.

In the transmission brake control system use is made of model 7 x 19-35 cables, State Standard IOCT 2172-43. Textolite pulleys 3 and 7 (Fig.225) along with the pressed-in ball bearings are installed on brackets cast from magnesium alloy.

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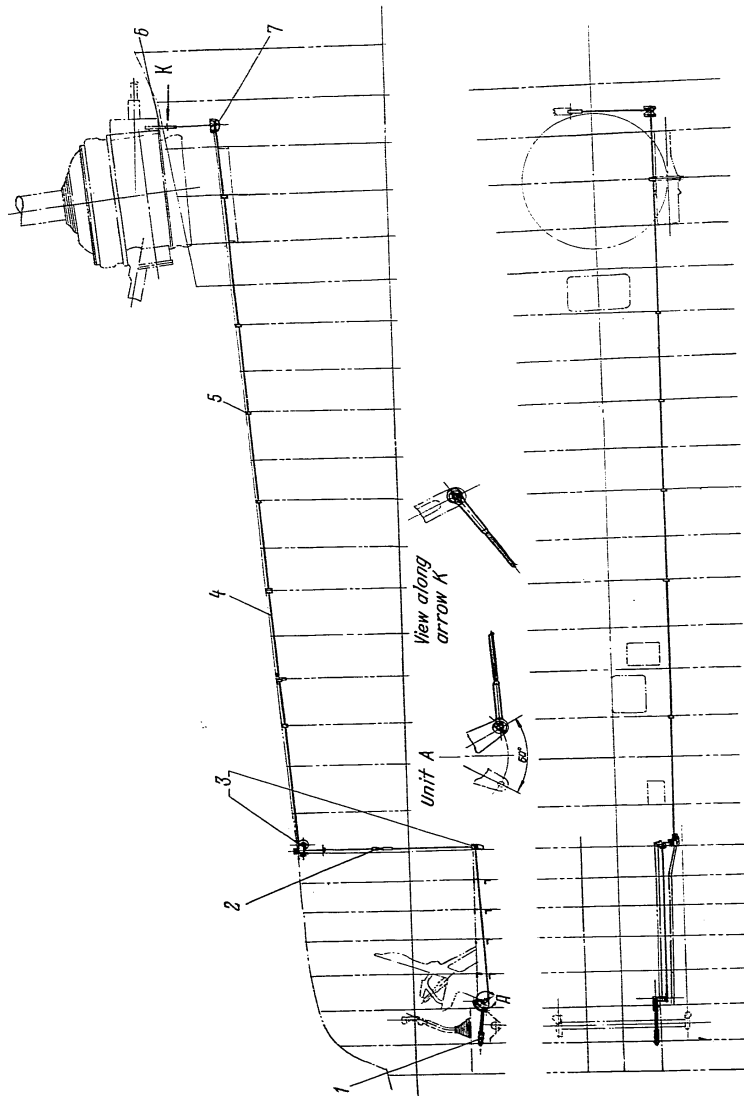


FIG. 225, TRANSMISSION BRAKE CONTROL DIAGRAM (21)
1 - handle; 2 - tumble; 3 - pulleys; 4 - cable; 5 - textolite guide; 6 - brake lever; 7 - pulley.

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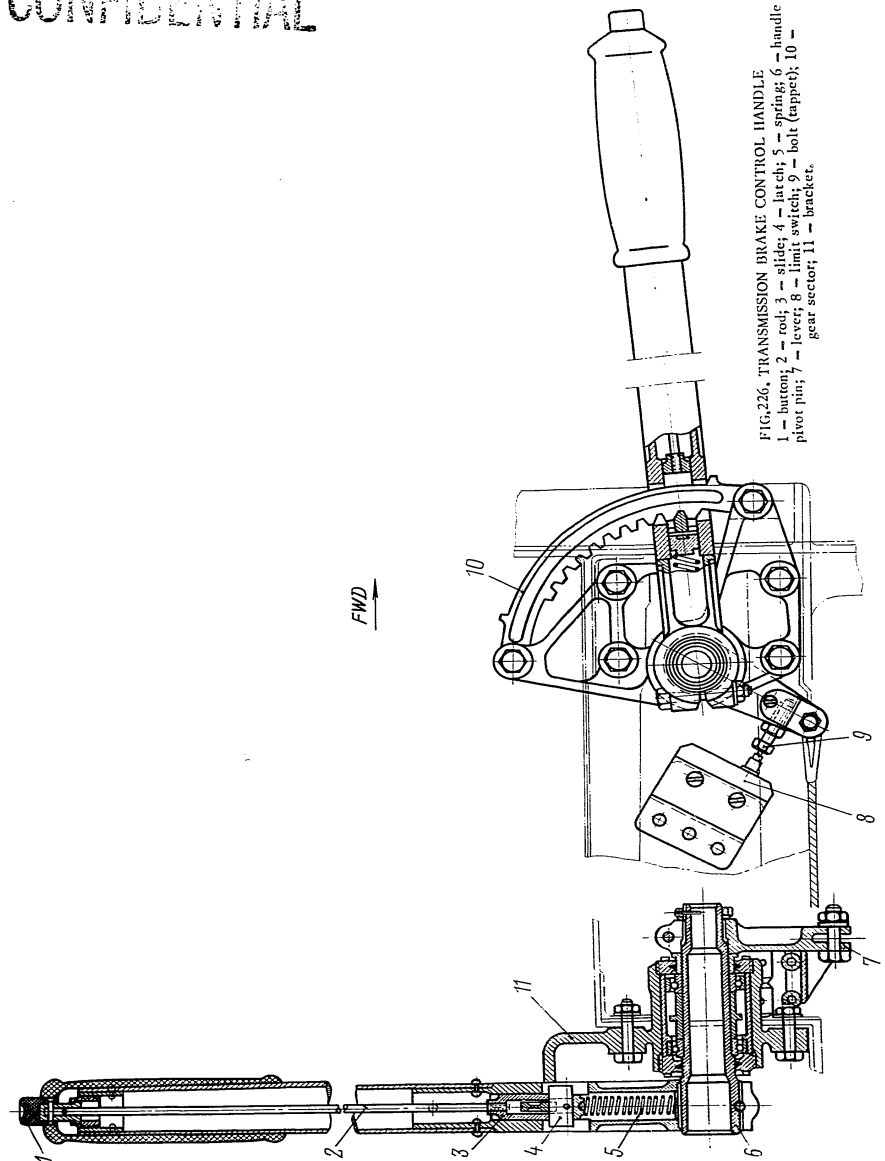


FIG. 226. TRANSMISSION BRAKE CONTROL HANDLE
1 - button; 2 - rod; 3 - slide; 4 - latch; 5 - spring; 6 - handle
pivot pin; 7 - lever; 8 - limit switch; 9 - bolt (tappet); 10 -
gear sector; 11 - bracket.

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The holes in the frames, through which the cable is passed, are edged with textolite guides 5.

SWASHPLATE

The swashplate is a mechanism which permits changing the value and direction of the resultant of the main rotor aerodynamic forces (main rotor thrust).

The resultant is changed in value through simultaneously changing the setting angles of all the blades by the same amount, i.e. by alteration of the main rotor collective pitch.

The direction of the resultant can be changed by inclining the plane of rotation of the swashplate ring which results in a cyclic change of the blade setting angles (as the plane of swashplate rotation is inclined, the setting angle of each particular blade is changed in accordance with the sine law as a function of the blade azimuthal position).

The swashplate (Fig.227) is mounted on the main gear box. The guide for the swashplate (inside which the gear box shaft is passed) is secured to the gear box flange with eighteen studs. The guide serves for the swashplate slide to move in along with the swashplate ring assembly hinged to it and the longitudinal and lateral control bell cranks.

The swashplate ring is rotated by the carrier whose shackle is secured to the bracket mounted on the main gear box shaft. The end universal joints of the swashplate ring are connected through rods with the blade turning arms.

The swashplate is controlled by means of hydraulic boosters operating the collective pitch lever and the longitudinal and lateral control bell cranks.

The swashplate comprises the following main parts: slide guide 13, slide 14, inner gimbal ring 53, outer gimbal ring 15, swashplate ring 42, collective pitch lever 1, longitudinal and lateral control bell cranks 32 and 57, longitudinal and lateral control rods 50 and 37, blade turning arms 44, and swashplate ring carrier 43.

Guide 13 consists of a cast steel plate and a tube which is smooth on the outside and supplied with ribs on the inside. The tube is connected to the plate with the aid of a flange and eighteen bolts. Plate 58 is provided with two pair of lugs by means of which it is connected to support 26 of the collective pitch control lever shackle.

Slide 14 moves over the cylindrical chrome-plated surface of the guide. The sliding bearings of the slide are made in the form of bronze bushings 16 and 39 and are sealed by scraping collar 28 and sealing ring 29 in the upper portion of the slide, and by collar 41 and ring 40 in the lower portion of it.

In the middle, the slide is provided with two seats for the attachment of the collective pitch lever and a projection fitted with lugs for the installation of longitudinal control bell crank 32. Mounted in the slide upper portion are two lugs which receive pins 64. These pins carry two-row spherical roller bearings 65 connecting the slide with inner gimbal ring 53. Inner gimbal ring 53 and outer gimbal ring 15 are interconnected with the aid of similar two-row spherical roller bearings and pins 52 and 66.

Outer gimbal ring 15 carries two-row radial-thrust ball bearing 18 mounted on which is swashplate ring 42. In the lower portion of ring 15 there is a recess located at right angles to the recesses for pins 52 and 66. This recess serves for

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the attachment of pin 63 mounted on which is longitudinal control rod 37. The other support for pin 63 is in box 61. The latter is centred by means of two locating pins 60 and secured to the outer gimbal ring with six bolts. Box 67 is attached in a similar way; this box serves as a second support for pin 66 receiving lateral control rod 50.

The longitudinal and lateral control rod-to-outer gimbal ring attachment points are displaced by 26° with respect to the helicopter longitudinal and lateral axes. Such an arrangement of the attachment points ensures independence of the longitudinal and lateral controls.

The common axle of the pins that connect the inner gimbal ring with the slide is located normal to the common axle of the pins interconnecting the gimbal rings.

The outer gimbal ring is secured to the slide with the aid of a universal joint which permits tilting the swashplate ring plane of rotation in any direction with regard to axis of rotation of the main rotor.

Swashplate ring 42 is a welded structure comprising a ring, five pair of ribs, and the upper and lower shells stamped from sheet steel. The respective shell elements are welded to one another and to the ribs.

Mounted in the lugs of each pair of ribs is the blade turning arm universal joint employing needle bearings. The joint consists of the following main parts: end universal joint pin 10 arranged in the rib lugs and pin 7 whose axis is normal to the axis of pin 10.

The universal joints of the blade turning arms are lubricated through the grease fittings of covers 8 and sealed by rubber rings 6 and 9. Welded into one of the links of the swashplate ring is a sleeve receiving carrier 43.

Longitudinal control bell crank 32 is mounted in two tapered roller bearings on axle 31 slipped through the lugs on the slide projection and secured in place with bolt 34. One arm of bell crank 32 is connected through rod 37 with outer gimbal ring 15; linked to the other arm of the bell crank is the rod led from the longitudinal control system hydraulic booster.

Lateral control bell crank 57 is carried in two tapered roller bearings, too. These bearings are mounted on pin 56 of the collective pitch lever. One arm of bell crank 57 is linked to the outer gimbal ring through rod 50; connected to the other arm of the bell crank with the aid of pin 59 is the rod running from the lateral control system hydraulic booster.

Rods 50 and 37 are coupled with the longitudinal and lateral control bell cranks through spherical bearings of the IIC type mounted on pins 35. The like bearings slipped onto pins 63 and 66 connect these rods with the outer gimbal ring. The rod heads are protected by boots 62 and 49.

Collective pitch lever 1 consists of two cheeks interconnected by crossmember 5 and bolt 2. The lever is linked to shackle 3 by pin 4 mounted in two needle bearings. Shackle 3 is connected to support 26 just in the same manner.

The collective pitch lever is joined with the slide through pins 30 and 56 and two-row spherical roller bearings 54. These bearings are lubricated with the aid of grease fittings screwed into the lever cheeks. The bearings are sealed with rubber rings 55.

The other end of the lever is connected to the rod running from the collective pitch control system hydraulic booster.

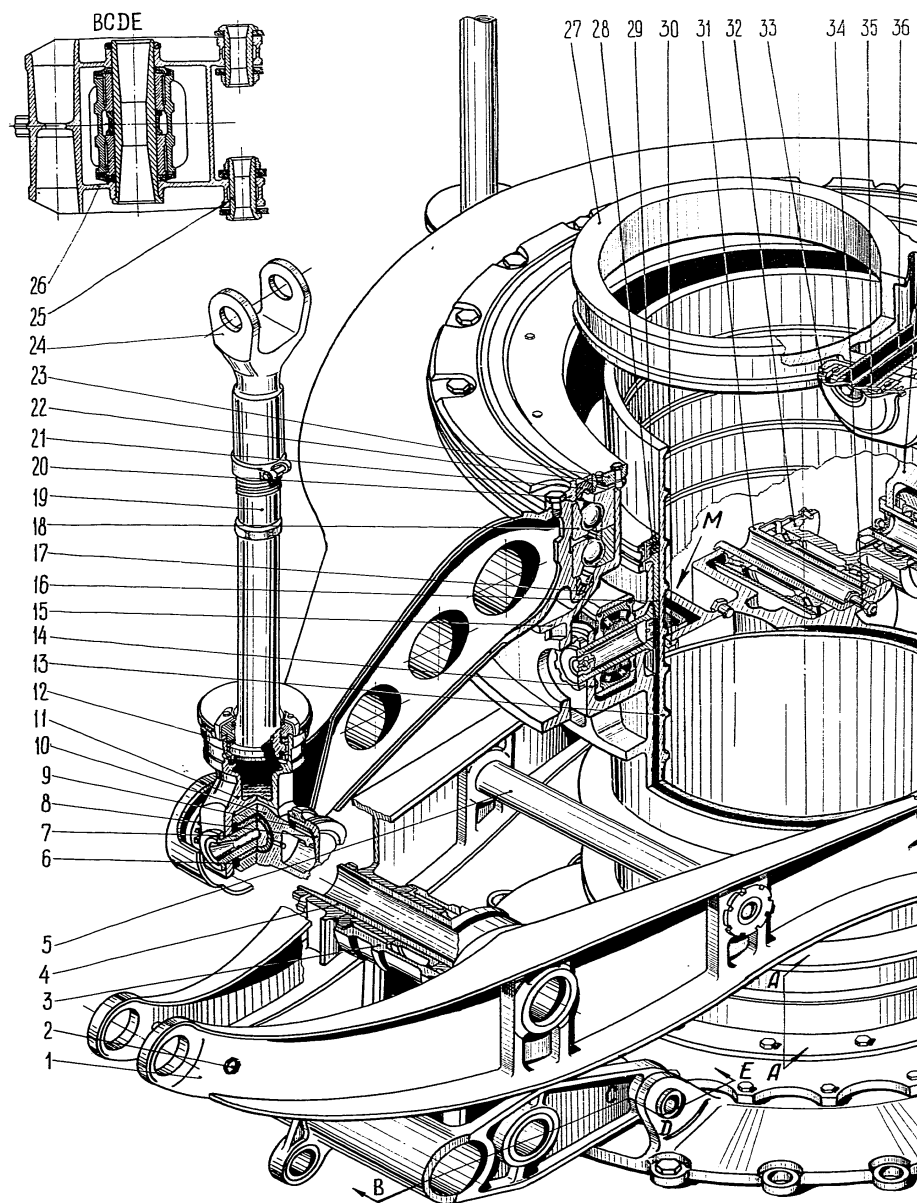
Support 26 is linked to the lugs of plate 58 by pins 25. The front part of the support is hinged to the hydraulic booster plate with the aid of a spherical bearing, type WM.

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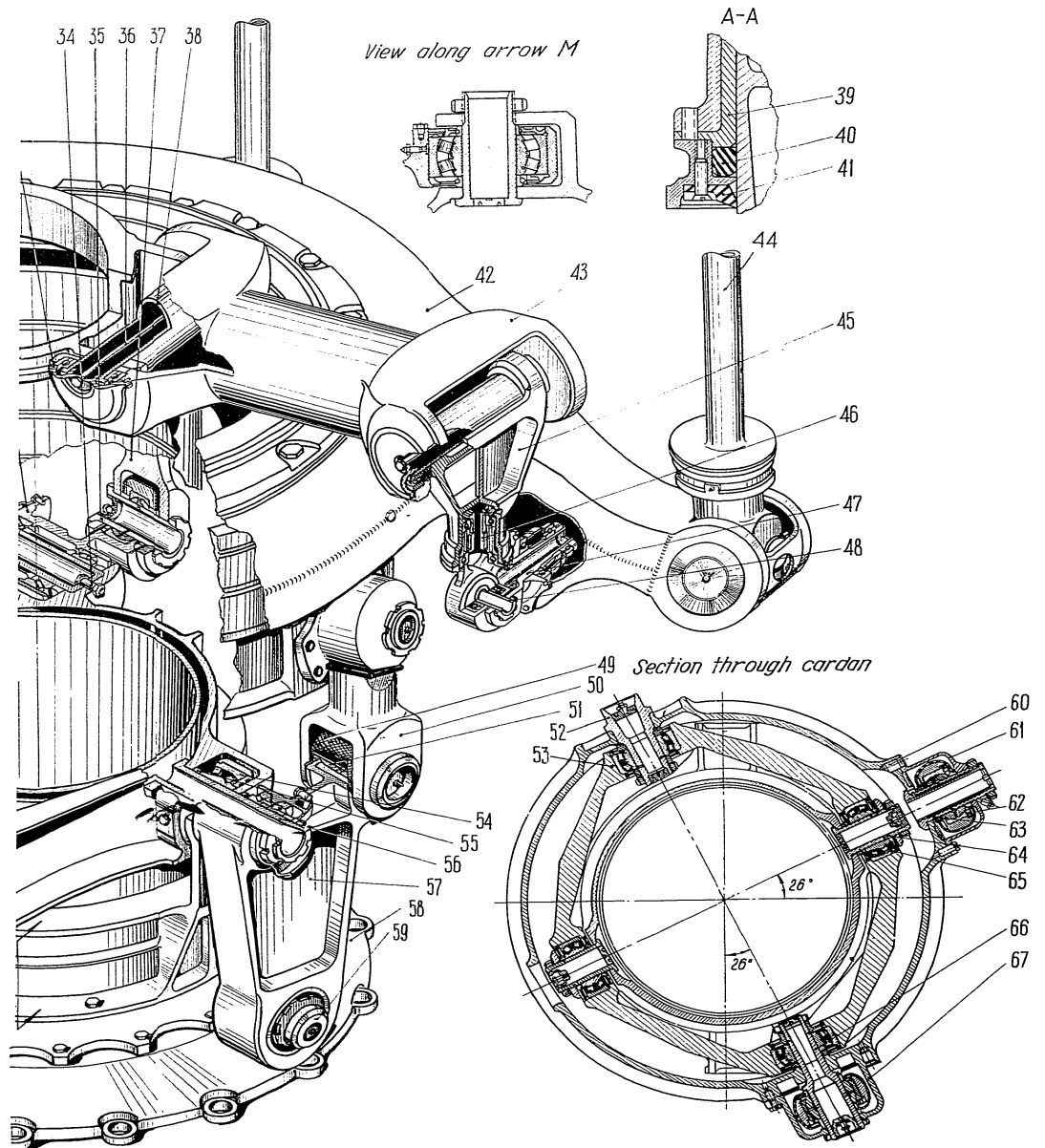
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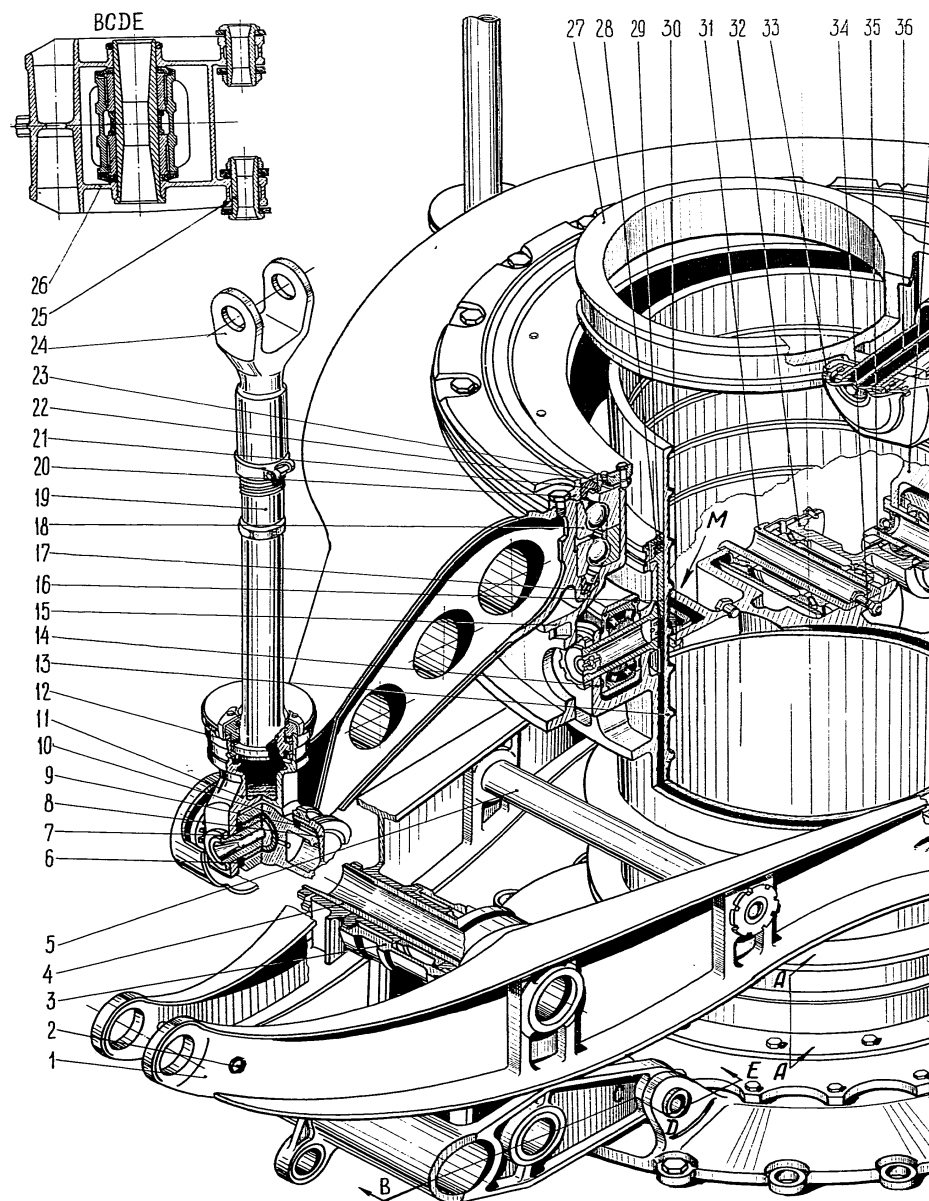
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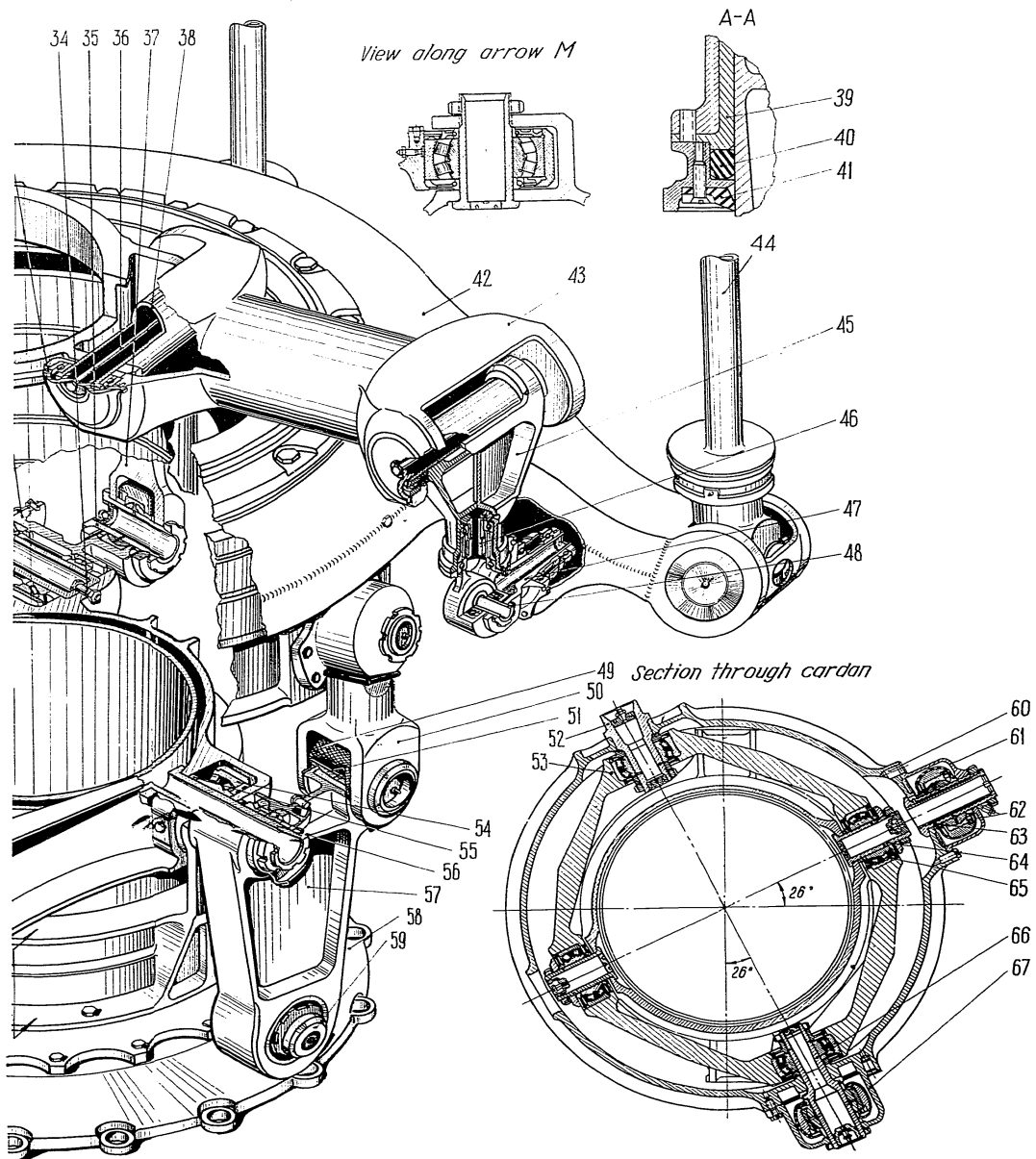
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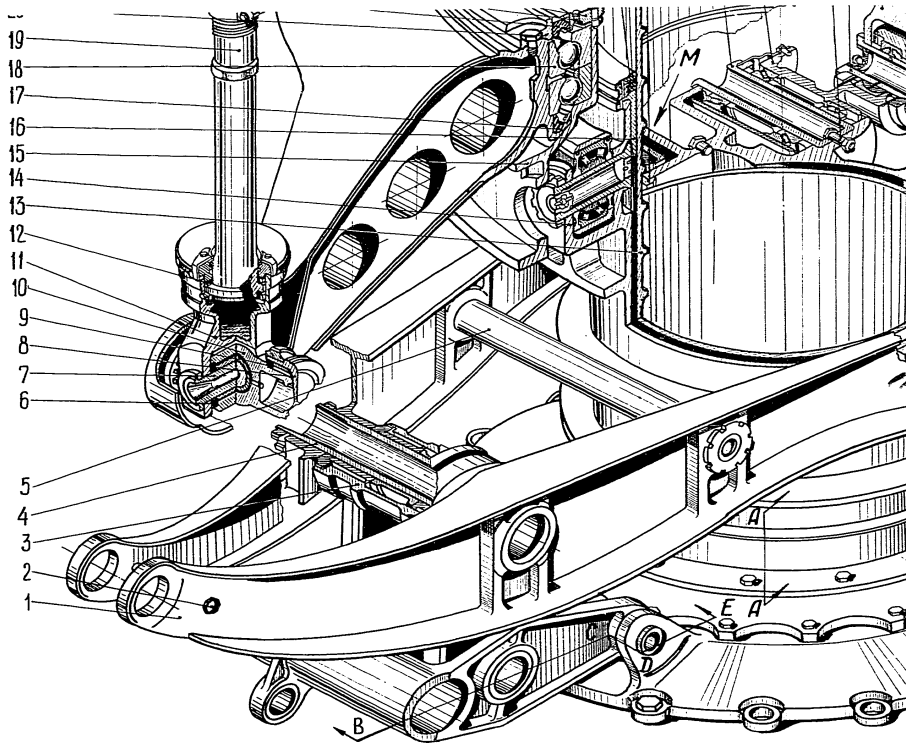
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1 - collective pitch lever; 2 - bolt; 3 - shackle; 4 - pin; 5 - crossmember;
 6 - sealing ring; 7 - pin; 8 - cover; 9 - sealing ring; 10 - end universal joint
 pin; 11 - lower fork; 12 - thrust roller bearing; 13 - slide guide; 14 - slide;
 15 - outer gimbal ring; 16 - bushing; 17 - collar; 18 - two-row ball bearing;
 19 - arm stem; 20 - flange; 21 - collar; 22 - safety valve; 23 - flange; 24 -
 upper fork; 25 - pin; 26 - support; 27 - shackle bracket; 28 - scraping collar;

FIG. 227. S
 29 - sealing ring; 30 - pin; 31 - axl
 32 - cover; 34 - bolt; 35 - pin; 36 -
 38 - axle; 39 - bushing; 40 - sealin
 42 - swashplate ring; 43 - swashpla
 turning arm; 45 - carrier lever; 46 -

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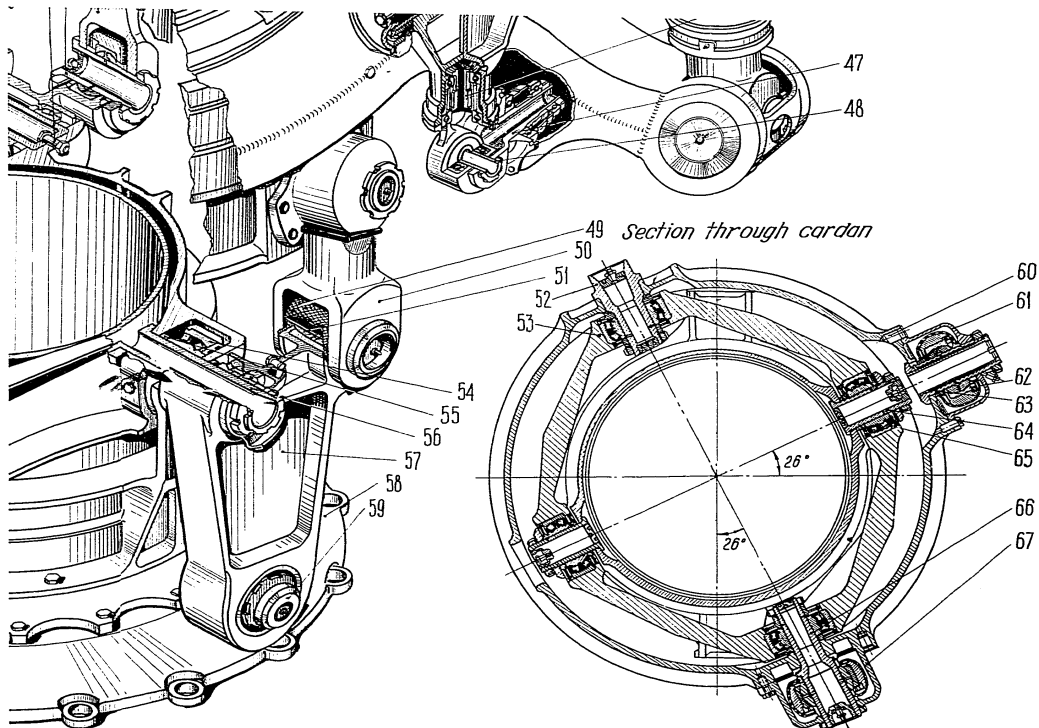


FIG. 227. SWASHPLATE

— pin; 31 — axle; 32 — longitudinal control bell crank;
 35 — pin; 36 — stud; 37 — longitudinal control rod;
 40 — sealing ring; 41 — scraping collar;
 43 — swashplate ring carrier (carrier shackle); 44 — blade
 lever; 46 — carrier gimbal shaft; 47 — carrier

gimbal fork; 48 — pin; 49 — boot; 50 — lateral control rod; 51 — pin; 52 — pin;
 53 — inner gimbal ring; 54 — spherical roller bearing; 55 — sealing ring;
 56 — pin; 57 — lateral control bell crank; 58 — plate; 59 — pin; 60 — locating
 pin; 61 — box; 62 — boot; 63 — pin; 64 — pin; 65 — spherical roller bearing;
 66 — pin; 67 — box.

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The swashplate ring is rotated by carrier 43 which comprises shackle bracket 27, carrier shackle 43, and carrier lever 45.

Being mounted on the main gear box shaft, shackle bracket 27 is prevented against rotation by a projection entering the respective slot in the hub body. Secured to the bracket by axle 38 carried in two ball bearings is carrier shackle 43.

The bearing outer races are secured in the shackle by covers 33 braced by stud 36 through axle 38. Carrier shackle 43 is connected with carrier lever 45 in a similar way. Mounted in two ball bearings inside carrier lever 45 is carrier gimbal shaft 46 which is linked through pin 48 to fork 47 carried in two ball bearings inside the swashplate ring sleeve.

Blade turning arm 44 comprises stem 19, upper fork 24, and lower fork 11.

The upper fork is screwed onto blade turning arm stem 19, which permits adjustment of the arm length. The lower fork, mounted on the arm stem with the aid of two thrust roller bearings 12, enters the end universal joint of the swashplate ring.

The upper fork is split which makes it possible to lock the fork with a coupling bolt.

Two-row radial thrust ball bearing 18 is secured in the swashplate ring with the help of flange 20. The bearing is attached to the outer gimbal ring by means of flange 23.

The swashplate ring assembly is provided with reinforced sealing collars 17 and 21 and is lubricated through grease fittings screwed into the pipes which are welded into the central ring of the swashplate. Safety valve 22 in flange 23 serves to check the swashplate ring assembly for proper filling with lubricant.

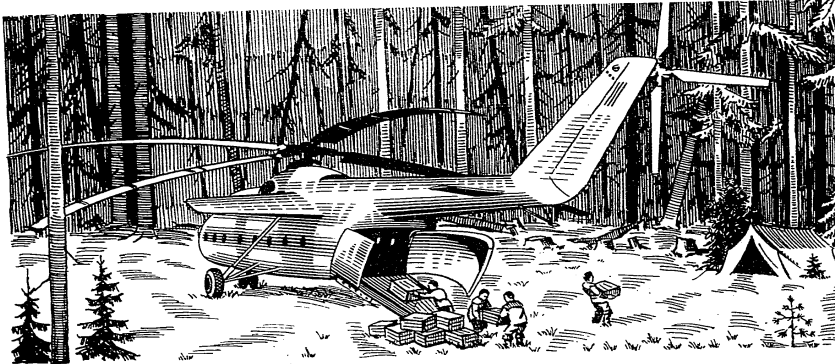
The swashplate is adjusted with the aid of scales, graduated in swashplate ring inclination angles, and verniers. The scales are mounted on axle 31 and pin 56, and the verniers, on bell cranks 32 and 57.

The scales and verniers provide for the required adjustment of the swashplate, i.e. for tilting the swashplate ring in the longitudinal and lateral planes accurate within 10 to 15° without having to use an optical quadrant or set the helicopter in a position at which the main rotor axis is vertical.

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Chapter VII

TAIL ROTOR

GENERAL

The purpose of tail rotor AB-63E-X6E (Fig.228) is to counterbalance the driving torque of the main rotor and to ensure directional control of the helicopter.

Type AB-63E-X6E rotor is a four-blade pushing rotor whose pitch can be controlled while in flight.

During turns to the left at autorotation duty, the tail rotor may be reversed and caused to operate as a tractor one.

The rotor is mounted on the output shaft of the tail gear box carried on the fin beam.

The rotor pitch is controlled mechanically by operating the foot pedals in the pilots' cabin. Changing the rotor pitch results in a rotor thrust change which causes the helicopter to turn in the respective direction. In straight flight, the rotor thrust direction is normal to the direction of flight.

To considerably reduce the bending moment acting on the tail gear box shaft, as well as to reduce the alternating stresses in the blade attachment fittings, the tail rotor hub is provided with flapping hinges whose axes are located in the plane of rotor rotation.

As the rotor pitch is changed, the blade turns in its attachment fitting (feathering hinge). The blades are turned due to the translational motion of the pitch control carrier which is connected with the blade turning arms on the feathering hinge bodies by means of rods.

The tail rotor is fitted with a de-icing device employing electrical heaters. The de-icing system ensures normal operation of the tail rotor under ice formation conditions.

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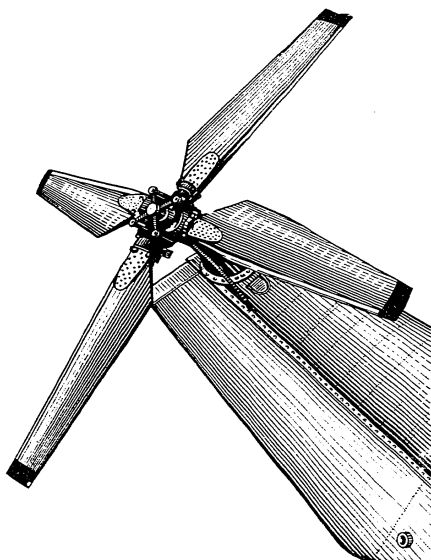


FIG. 228. TAIL ROTOR AB-43B-X615 MOUNTED ON TAIL GEAR BOX.

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Basic Specifications

Type of rotor	pushing, controllable while in flight
Rotor diameter	6.3 m
Number of blades	4
Blade width at $r = 0.7$	500 mm
Relative blade thickness at $r = 0.9$	0.096
Blade profile	NACA-230
Weight of one blade	60 kg
Rotor solidity ratio	0.202
Blade deflection angle from plane of rotation in flapping motion	+23 to -9°
Blade turning range	32°
Weight of rotor	570 kg

CONSTRUCTION OF TAIL ROTOR

The AB-63E-X65 tail rotor (Fig.229) consists of the following main parts: body, spiders with feathering hinge trunnion, feathering hinge barrels, pitch control carrier, and blades.

Hub body 7 has four lugs each carrying in three needle bearings flapping hinge pin 10 which secures spider 11 to the feathering hinge trunnion. The body has a hole with involute splines for installation of the tail rotor on the output end of the tail gear box shaft and is centred on the shaft by front cone 4 and rear cone 8. After being installed on the shaft, the hub is secured in place with nut 3.

The spider trunnion is connected with barrel 13 through three rows of 1/2" - dia. balls 12, each row containing thirty-five balls. The balls are held in a cage made from aluminum alloy. Thus, the spider trunnion acts as the inner race, and the feathering hinge barrel, as the outer race of the feathering hinge bearing. Preloading all the three rows of the feathering hinge bearing balls is accomplished by nut 15 through thrust roller bearing 14.

The face of the feathering hinge barrel is provided with three lugs for the attachment of the blades, and the cylindrical surface of it, with two diametrically opposite flats for securing the counterweight and the blade turning arm.

The purpose of blade turning arm 16 is to convert the translational motion of the carrier spider into rotary motion of the feathering hinge barrel. The arm body is secured to the barrel flat with four bolts.

The blade turning arm is linked to the carrier spider through adjustable rod 2 by changing whose length it is possible to adjust the blade setting angle.

The blade turning rod is connected to the carrier spider through a spherical bearing, and to the blade turning arm, through a universal (cardan-type) joint.

Pitch control carrier spider 1 is mounted on the gear box slide with the aid of splines and centring cones just in the same way as the rotor hub body. The spider is held in an angular position with respect to the body by one cut-off spline of the spider and by a locating pin on the slide. Installed at each of the four spider arm ends are the hinged connections for the blade turning rods.

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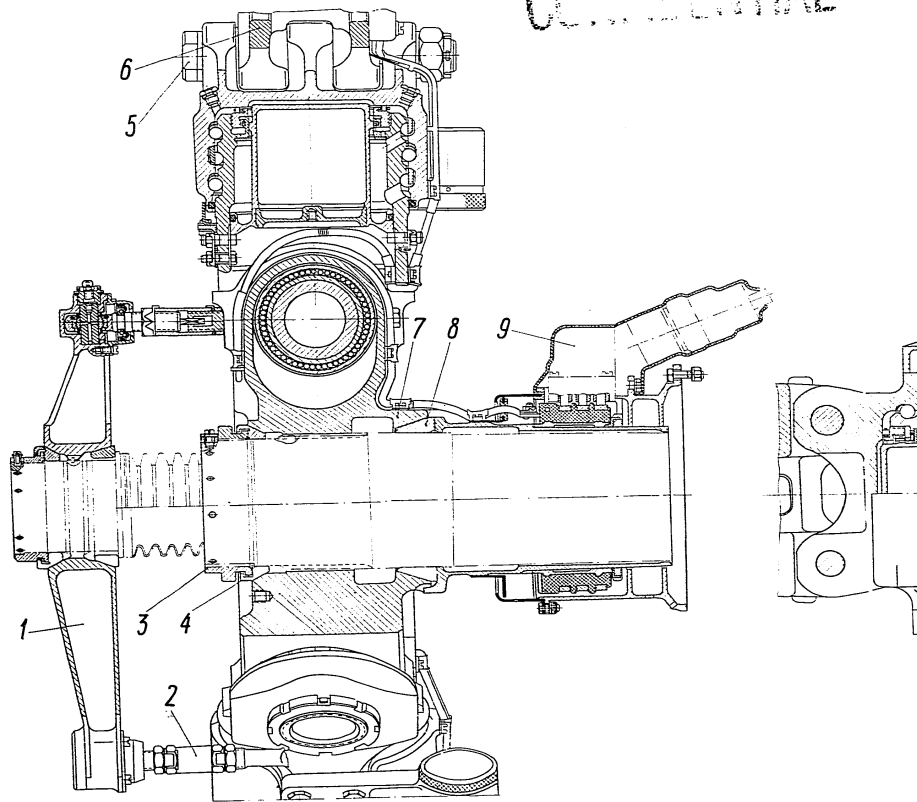


FIG. 229. HUB OF AB

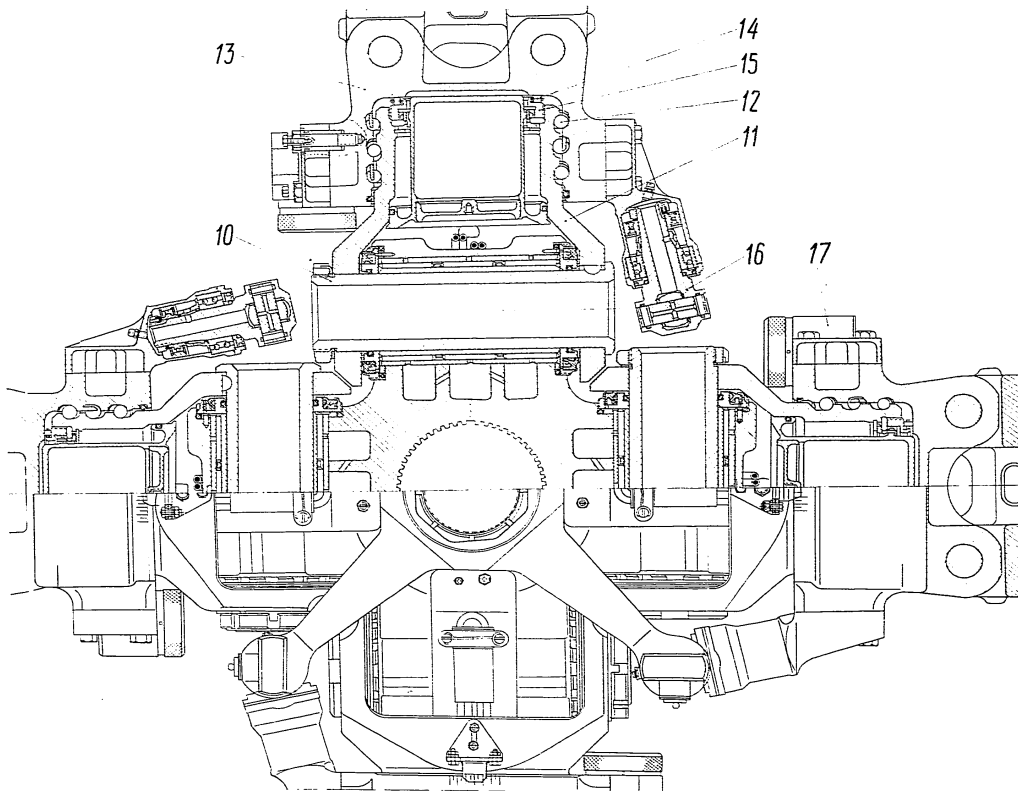
1 - pitch control carrier spider; 2 - rod; 3 - nut; 4 - attachment lug; 7 - hub body; 8 - rear cone; 9 - tail pivot pin; 11 - spider with feathering hinge trunnion; 13 - feathering hinge barrel; 14 - roller bearing; 15 - 17 - counterweight

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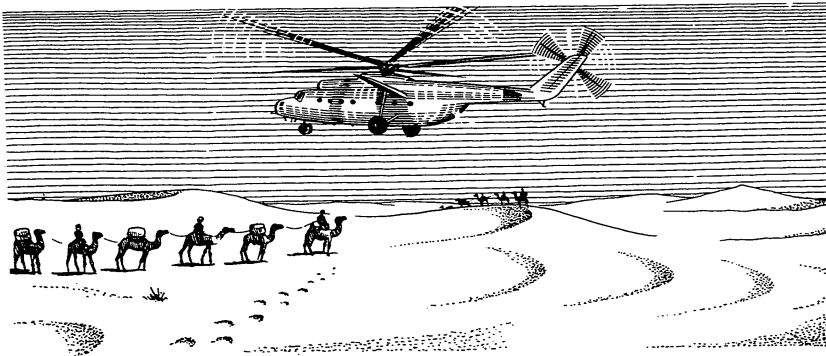
JB OF AB-63B-X65 TAIL ROTOR
 - nut; 4 - front cone; 5 - coupling bolt; 6 - blade
 7 - tail rotor slip ring assembly; 10 - flapping hinge
 trunnion; 12 - feathering hinge bearing balls;
 ring; 15 - nut; 16 - blade turning arm;
 counterweight.

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Chapter VIII

AUTOPILOT

The Mi-6 helicopter employs the AI-31B three-channel autopilot which stabilizes the helicopter pitch, roll, and course angles while in flight and permits the performance of evolutions with the aid of the three-channel control knob.

The autopilot set comprises the following units: central vertical gyro IIB-2, angular velocity transmitter, control unit, control panel, three-channel control knob, feedback transmitters, autopilot cut-in button, and autopilot cut-off buttons.

Used as a course angle transmitter is the IYK-1 gyro induction compass incorporated in the helicopter navigational equipment set.

The function of servo drives is performed by the helicopter control system hydraulic boosters in conjunction with the special control units, type AV-33, which are essentially solenoid-operated devices with a slide valve controlled by the autopilot.

When installed on the helicopter, the autopilot only operates provided that the hydraulic boosters are fed from the main hydraulic system. In case the main hydraulic system is cut off or fails in operation, the autopilot is automatically switched off, whereas the hydraulic boosters are simultaneously changed from the main hydraulic system over to the duplicating one for manual control. Hence, apart from normally switching off the autopilot by means of the IA-192 valve, the pilot may also switch it off by putting the main hydraulic system out of operation. An additional guarantee for switching off the autopilot is provided through use of two IA-192 solenoid-operated hydraulic valves connected in series into the hydraulic line.

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CHANGE-OVER OF HYDRAULIC BOOSTERS FOR CONTROL FROM AUTOPILOT

The autopilot is switched on by depressing the button located on the left-hand instrument panel in the pilots' cabin. Simultaneously with depressing the button, hydraulic fluid is fed by the PA-I92 valve (which is electrically connected with the autopilot cut-in button) from the main hydraulic system to the cavities of the hydraulic booster plungers (for the description of the hydraulic booster, refer to Chapter X).

As a result, the plunger is displaced to change the hydraulic booster for control from the manual system slide valves over to the autopilot slide valve incorporated in control unit AV-33. The schematic diagram of hydraulic booster supply from the autopilot is presented in Fig. 230.

When the autopilot is switched off, the PA-I92 valve operates to connect the cavities of the hydraulic booster plungers to the return line, while the plungers are caused by their springs to move to a position at which the hydraulic boosters are operated from hand-controlled slide valves. The PA-I92 valve is so connected into the system that in case of damage to the electric circuit the autopilot is switched off and the helicopter control is changed over for the hand control system.

In addition to the special autopilot cut-off buttons, provision is made for automatically switching off the autopilot when the foot control pedals (or control stick) are deflected as far as they will go in the longitudinal direction or when the helicopter control stick is shifted away from neutral by an amount equal to 60% the swashplate inclination range. In this case, the autopilot is switched off by means of the limit switches connected into the autopilot electric circuit.

ARRANGEMENT OF AUTOPILOT UNITS

The arrangement of the autopilot units on board the helicopter, as well as the arrangement of the units designed to change the hydraulic boosters from hand control over to control by the autopilot is shown in Fig. 231.

The MFB-2 central vertical gyro and the control unit are mounted on a special rack (see Fig. 232) riveted to the web of frame No. 1 on the side of the cargo compartment (see Fig. 231).

The JVC angular velocity transmitter unit (Fig. 233) is located on a special support between frames Nos 13 and 14 under the cargo compartment floor. To mount the angular velocity transmitter unit on the helicopter, provision is made for a hatch cut in the fuselage port side. To ensure correct installation of the angular velocity transmitter and proper laying of the bunched conductor to the unit, there are an inspection hatch and a production hatch located in the floor of the cargo compartment and in the inner partition of the fuselage.

The purpose of the central vertical gyro is to generate pulses proportional to the roll and pitch angles.

The angular velocity transmitter is a gyroscopic instrument which serves to produce pulses proportional to the rates of helicopter movement with respect to its three main axes.

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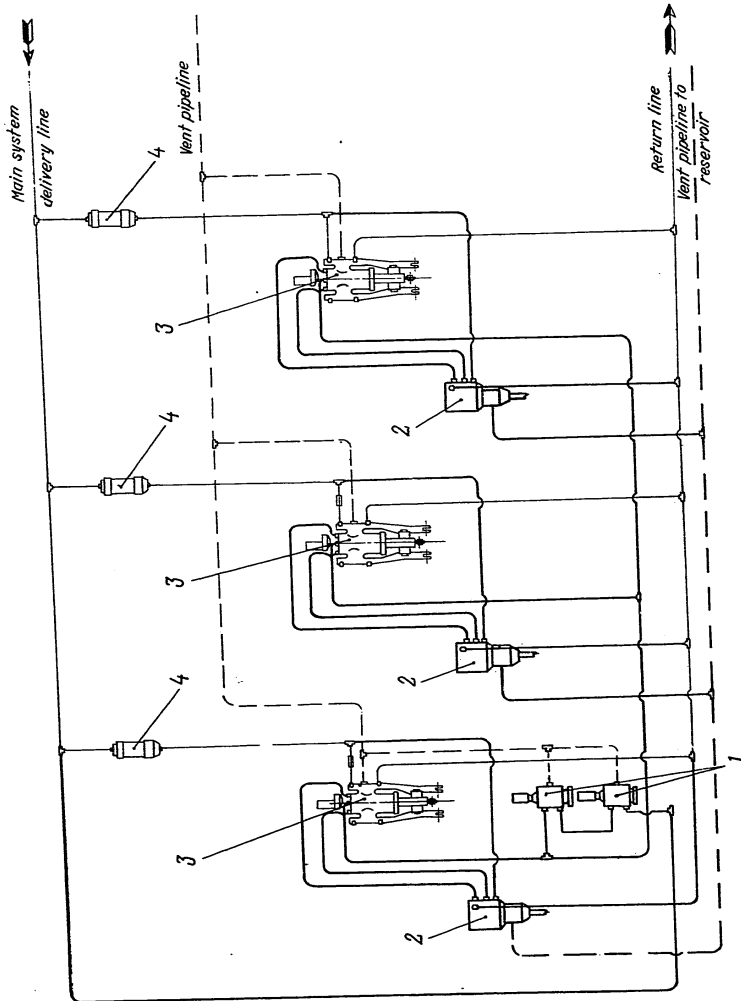


FIG.230. SCHEMATIC DIAGRAM OF HYDRAULIC BOOSTER SUPPLY FROM AUTOPILOT
1 - solenoid-operated hydraulic valves 1A-192; 2 - control unit AV-33; 3 -hydraulic boosters BY-33A of longitudinal, lateral, and direc-
tional control systems; 4 - main hydraulic system filter 14T93.

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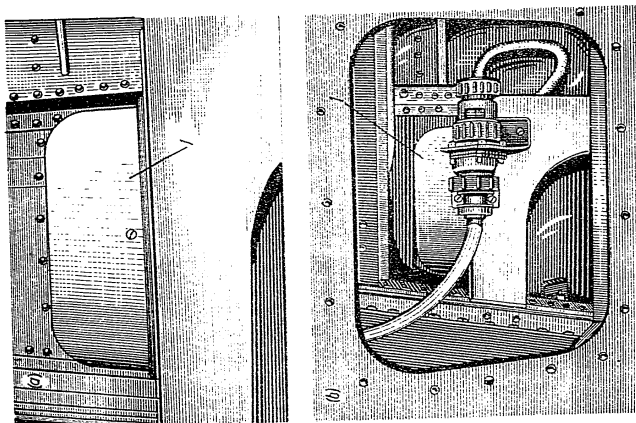


FIG.233. ANGULAR VELOCITY TRANSMITTER
(a) installation of transmitter (b) latch giving access to transmitter
1 - transmitter.

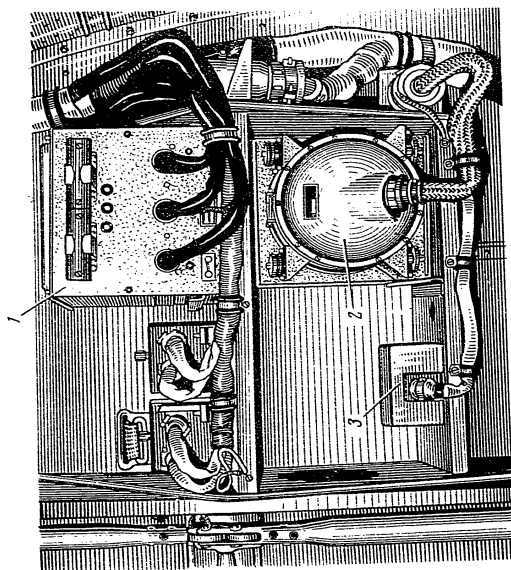


FIG.232. ARRANGEMENT OF AUTOPILOT UNITS ON SPECIAL RACK
1 - control unit; 2 - central vertical gyro IITB-2; 3 - 1'A-102 valve
cable-in relay box.

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The purpose of the control unit is to sum up, convert, and amplify the pulses, which come from all the other autopilot units, and to produce output control pulses sent to the special slide valve devices incorporated in the AY-33 units of the helicopter longitudinal, lateral, and directional control systems.

The three-channel control knob, control panel, and autopilot cut-off button are arranged on the central control panel (see Fig.234).

The three-channel control knob is used to control the helicopter in roll, pitch, and direction with the autopilot switched on for operation.

The control panel serves to cut in power to the autopilot, to indicate that the autopilot is ready for operation and that the autopilot has started to operate, as well as to show to the pilot the position of the vertical gyro in case the latter deflects from its normal position.

The autopilot cut-in and cut-off buttons are intended for controlling power supply to the autopilot. In addition to the already mentioned cut-off button located on the pilots' central control panel, there are like buttons on both of the helicopter control sticks. Autopilot cut-in button 2 (Fig.231) is arranged on the left-hand instrument panel in the pilots' cabin (Fig.235).

The function of the AOC feedback transmitters is to produce electric pulses proportional to the displacement of the helicopter controls. Feedback transmitters 4 and 12 (see Fig.231) are secured to the hydraulic booster baseplates (Fig.236) with the aid of steel brackets. The feedback transmitter carrier is connected with the hydraulic booster bell crank through a rod adjustable in length.

The construction of the autopilot units and principle of their operation are dwelt upon in the AI-31B autopilot description.

Alternating current to the autopilot is fed from the HT-500H inverter which converts the 27-V direct current of the helicopter mains into a three-phase alternating current of 36 V, 400 c.p.s.

The autopilot system includes the BK-53 erecting cutout from the IVK-I gyro induction compass. The purpose of the cutout is to cut off the pendulum lateral erection mechanism of the HTB-2 vertical gyro with the helicopter subjected to lateral overloads (while performing turns).

The HT-500H inverter and BK-53 erecting cutout are mounted on the fuselage nose port side under the floor of the crew's cabins.

The three AY-33 control units are arranged near the three hydraulic boosters EV-33A of the hand and foot control systems, each control unit at its respective booster. Fig.237 presents the arrangement of the hand control system AY-33 unit. The schematic diagram of the AY-33 control unit is shown in Fig.238.

Needle 2 is displaced in accordance with the electric pulses sent by the autopilot. This causes slide valve 3, which follows the motion of the needle, to distribute the working fluid between the cavities of the hydraulic booster cylinder.

The pipelines connecting the AY-33 control unit with the hydraulic booster and the main hydraulic system delivery line are fabricated from stainless steel, whereas the return lines are made from AMT-M pipes.

Solenoid-operated valves 8 (see Fig.231) are mounted on the fuselage skin in the gear box compartment. For the description of the PA-I92 valve, refer to Chapter X.

Limit switches 11, which serve to automatically switch off the autopilot and change helicopter control over to the hand control system, are mounted on the bell

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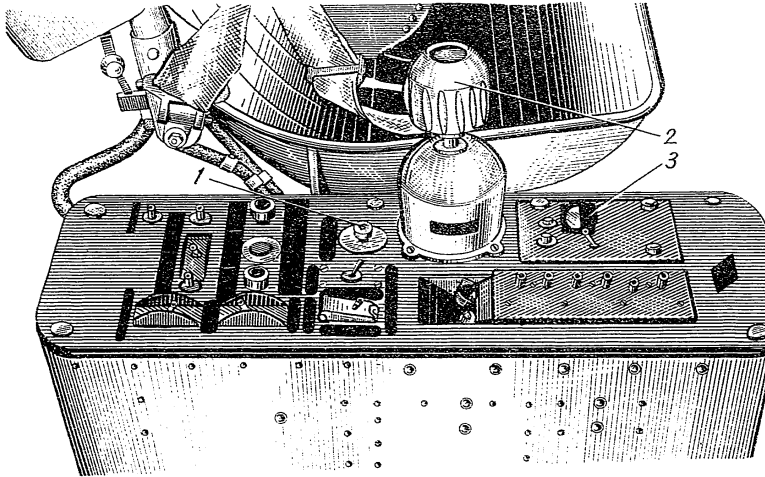


FIG. 234. ARRANGEMENT OF AUTOPILOT CONTROL KNOB AND CONTROL PANEL ON CENTRAL ELECTRICAL PANEL IN PILOT'S CABIN
1 - autopilot cut-off button; 2 - three-channel control knob; 3 - control panel.

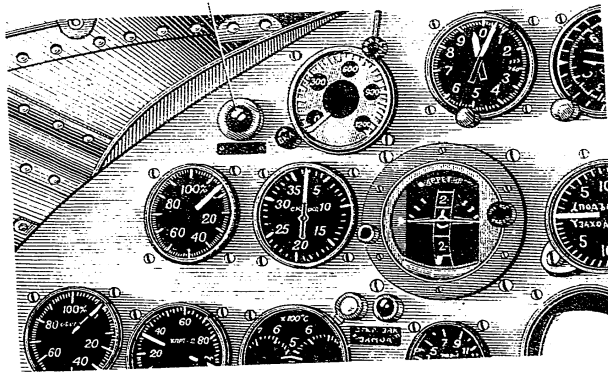


FIG. 235. ARRANGEMENT OF AUTOPILOT CUT-IN BUTTON ON LEFT-HAND INSTRUMENT PANEL IN PILOT'S CABIN
1 - button

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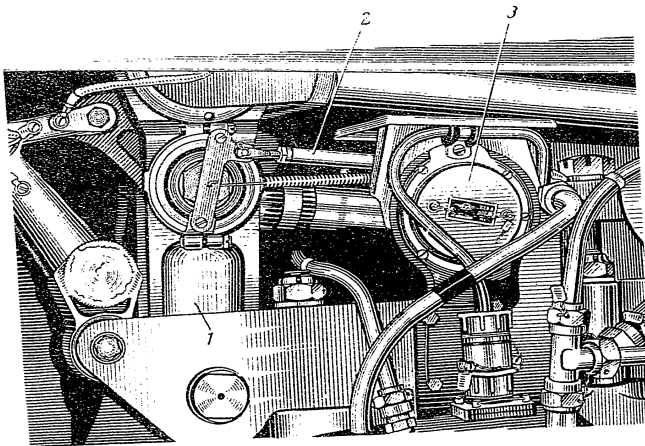


FIG. 236. VIEW OF FEEDBACK TRANSMITTER INCORPORATED IN HAND CONTROL SYSTEM
1 - hydraulic booster bell crank; 2 - rod; 3 - feedback transmitter.

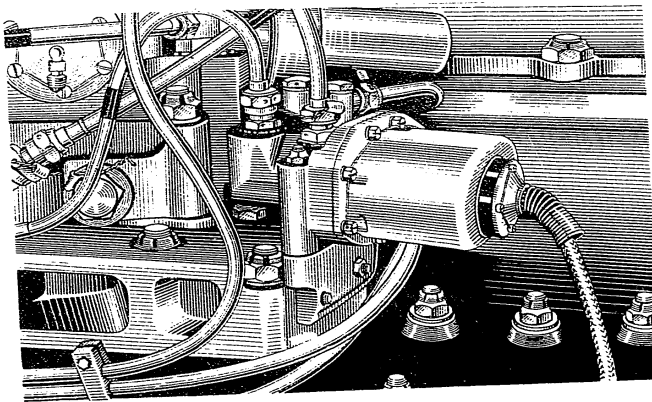


FIG. 237. CONTROL UNIT WV-33 INCORPORATED IN HAND CONTROL SYSTEM.

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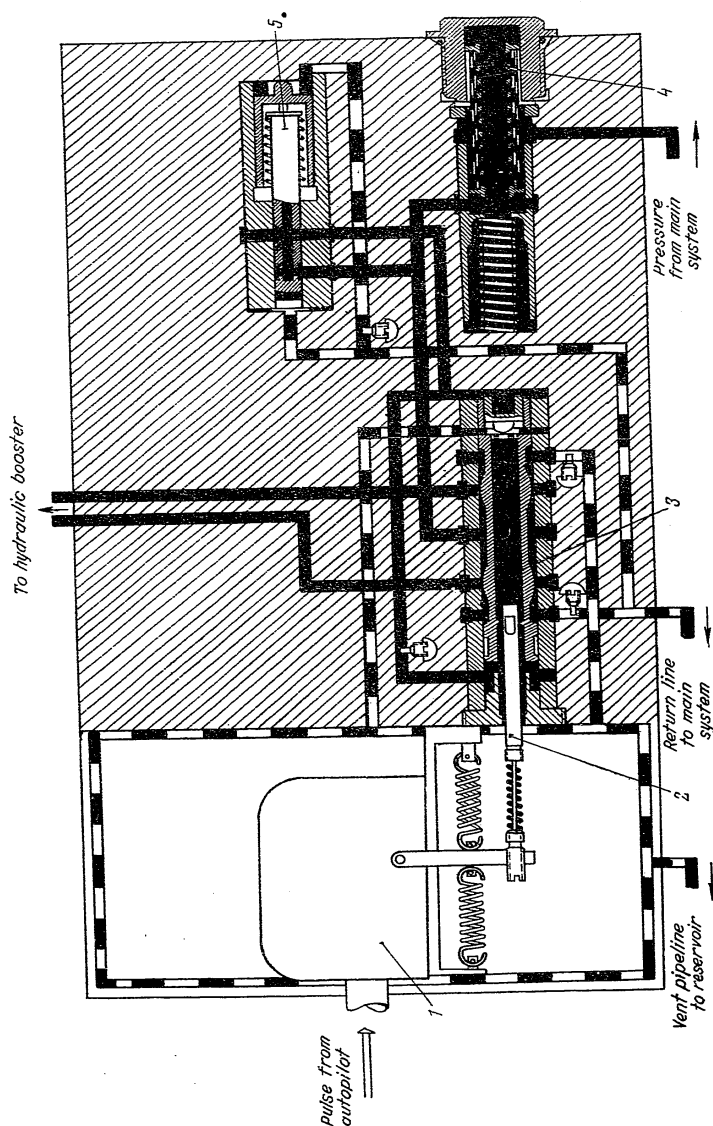


FIG.238. SCHEMATIC DIAGRAM OF AV-33 CONTROL UNIT
 1 - electromagnetic relay; 2 - needle; 3 - slide valve; 4 - gauge filter with non-return valve; 5 - pressure stabilizer.

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cranks located on frame No.1 of the fuselage central part (Fig.239 shows how the limit switch is installed).

Limit switch 1 and actuator plate 3 with a roller are secured on a bracket. The control bell crank is provided with sector 5 attached to which are bevelled plates 2. When the bell crank is deflected through a predetermined angle, the bevelled plate is pressed against the roller thus causing the limit switch to operate; as a result, the autopilot is switched off and the helicopter is changed for control over to the hand control system.

The bevelled plates are bolted to the bell crank sector. The bolts are slipped through oval holes, which permits adjustment of the helicopter controls deflection range at the end of which the autopilot becomes automatically switched off.

The autopilot may be switched on for operation once again by depressing the AUTOPILOT ON (BKJL. AM) button located on the left-hand instrument panel in the pilots' cabin.

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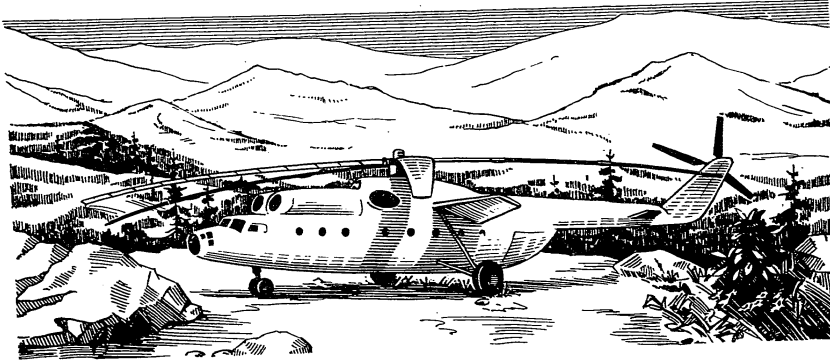
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Part Three
**LANDING GEAR, HELICOPTER SYSTEMS,
AND SLING SYSTEM**

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Chapter IX

LANDING GEAR

The helicopter non-retractable landing gear comprises nose wheels, two main wheels, and a tail bumper. The landing gear is fitted with oleo-pneumatic shock absorbers (shock struts) charged with fluid and gas (nitrogen).

The purpose of the tail bumper which is mounted at the end of the tail boom is to protect the tail rotor from shocks against the ground in case the helicopter lands like an airplane.

Basic Specifications

Main landing gear track	7500 mm
Wheel base	9005 mm
Parking angle	2° (reference line is inclined forward and upward)

MAIN LANDING GEAR LEGS

The two main landing gear legs arranged on both sides of the fuselage (Fig.240) are of the pyramid type. Each main landing gear leg comprises axle shaft 1 with a wheel, brace strut 3 and two-chamber shock strut 2. The main landing gear shock absorbing system includes also spring damper 5 along with pipeline 6 and arched wheel 4 with one-side compressed air chamber brake.

The upper ends of the landing gear axle shaft and the brace strut are secured to attachment units A and C (Figs 240 and 241) located in the lower part of the fuselage on frames Nos 18 and 22.

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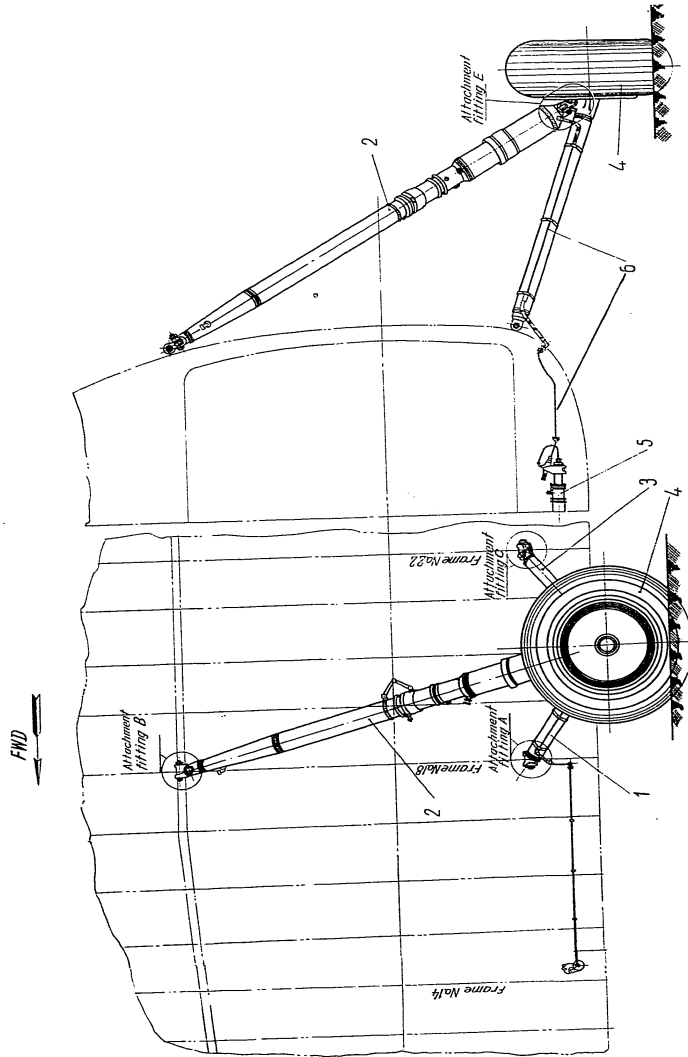
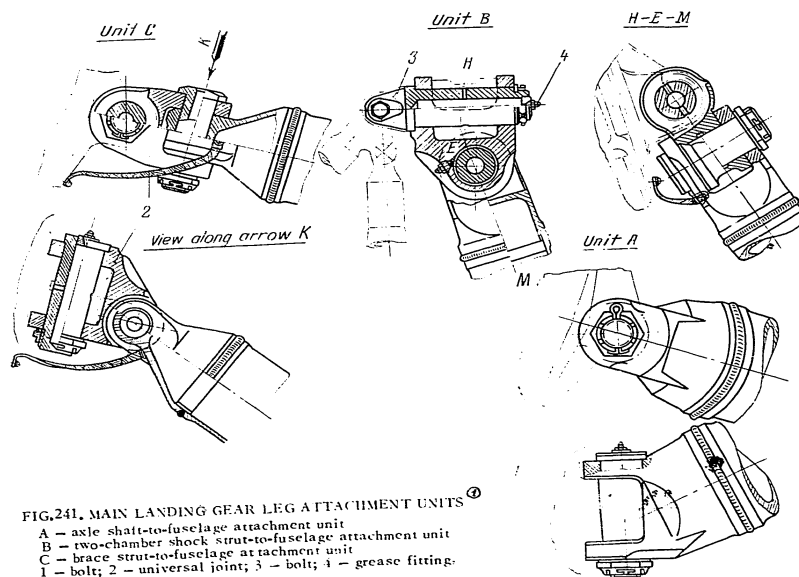


FIG.240, MAIN LANDING GEAR LEG

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The axle shaft is connected to the fuselage attachment unit with the aid of bolt hinge 1 whose axis is located in the horizontal plane (see Fig.241). The brace strut is secured to the fuselage by means of universal joint 2.

The upper end of the shock strut is connected through intermediate universal joints to attachment unit B secured to fuselage frame No.18 (see Figs 240 and 241), whereas the lower end of the strut is joined to attachment lug 4 (Fig.242) on the axle shaft.

The lower end of the landing gear axle shaft (see Fig.243) is provided with flange 2 which serves for the attachment of the wheel brake, lug 8 for the brace strut, lug 4 for the shock strut universal joint, lug 3 for the towing cable, and lug 9 (Fig.244) for a screw jack with a hole for the water to run down. Welded to the axle shaft is special sleeve 5 in which the grounding bar is secured. The wheel brake disc is attached to the axle shaft flange with the aid of twelve bolts 1 (Fig.242).

The axle shaft (see Fig.243) is made from 30XICA steel tube 6 machined on the outer and inner diameters. Secured to one end of the tube by means of electric arc welding is fork 7 serving to fasten the tube to the fuselage attachment unit on frame No.18. Welded to the other end of the tube is axle 1 with flange 2 made from forgings.

The fork, flange, and axle are 30XICA cromansil steel parts thermally treated to $\sigma_B = 120 \pm 10$ kg/sq.mm.

After welding is over, the axle shaft is not subjected to any thermal treatment. The axle shaft is zinc-plated and then painted with grey enamel XB-16.

The construction of the landing gear attachment units is shown in Figs 241 to 244.

All the coupling bolts are machined in compliance with the fine quality requirements from 30XICA cromansil steel, thermally treated to $\sigma_B = 120 \pm 10$ kg/sq.mm, and cadmium-plated. The bolts are tightened by castellated nuts and locked with cotter pins. The bolts on the universal joints are provided with grease fittings 4 (see Fig.241).

Ends of bolts 3, serving to secure the shock strut universal joint to the fuselage attachment unit on frame No.18, are provided with forks for the attachment of the rods and brace struts involved in installation of external fuel tanks on the helicopter.

The brace strut is made from 30XICHA steel tube 2 (Fig.245) machined on the outer diameter. Secured to one end of the brace strut by means of electric arc welding is lug 1 for the attachment of universal joint 2 (see Fig.241), and to the other end, fork 3 (see Fig.245) by means of which the strut is connected to lug 8 (Figs 243 and 244) on the axle shaft. The lug and the fork are made from steel 30XICHA. When assembled, the brace strut is subjected to isothermal treatment to $\sigma_B = 165^{+15}_{-5}$ kg/sq.mm, zinc-plated, and painted with grey enamel XB-16.

The two-chamber shock strut of the main landing gear (Fig.246) comprises high-pressure shock strut "B" and low-pressure shock strut "H" ("B" and "H" are Russian letters standing for "High" and "Low", respectively).

The high-pressure shock strut operates mainly during landing. Its performance characteristics are similar to those of common landing gear shock struts used on helicopters and airplanes. The most peculiar feature of the high-pressure shock strut is that it does not operate at small loads on the landing gear, being in this case, in a position at which the inner tube is completely extended.

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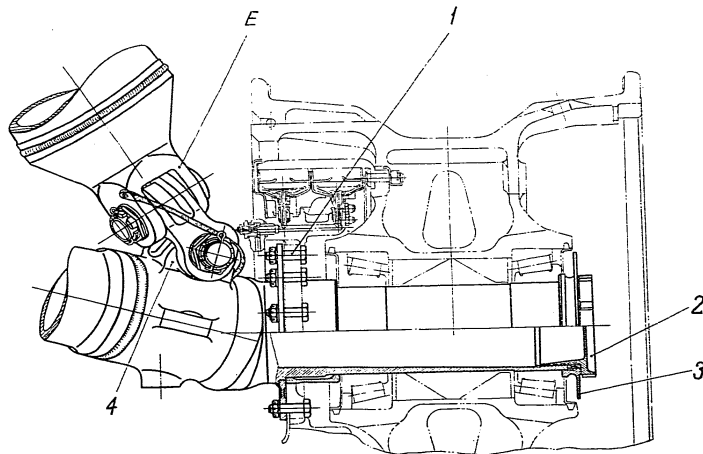
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FIG. 242. MAIN LANDING GEAR AXLE SHAFT WITH ATTACHMENT UNIT
FOR TWO-CHAMBER SHOCK STRUT
E - shock strut-to-axle shaft attachment unit
1 - brake coupling bolt; 2 - nut; 3 - flange; 4 - shock strut universal joint
attachment lug.

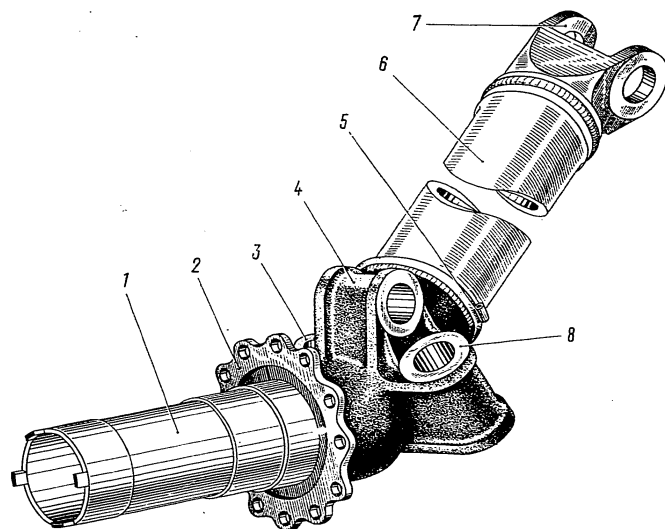


FIG. 243. MAIN LANDING GEAR AXLE SHAFT
1 - axle; 2 - flange; 3 - lug for towing cable; 4 - lug for attachment of shock strut
universal joint; 5 - grounding bar sleeve; 6 - tube; 7 - fork; 8 - brace strut attachment
lug.

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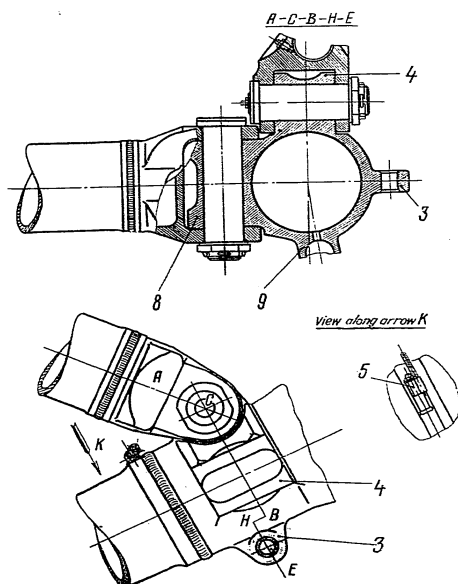


FIG.244. ATTACHMENT UNITS ON MAIN LANDING GEAR AXLE SHAFT
3 - lug for towing cable; 4 - lug for attachment of shock strut universal joint; 5 - grounding bar sleeve; 8 - brace strut attachment lug; 9 - lug for screw jack.

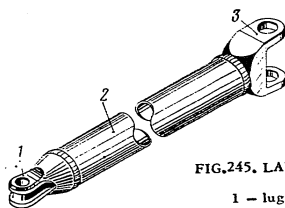


FIG.245. LANDING GEAR BRACE STRUT
1 - lug; 2 - tube; 3 - fork.

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The low-pressure shock strut operates at small loads on the landing gear. The purpose of this strut is to eliminate helicopter lateral vibration (of "ground resonance" type); such vibration is liable to appear during the landing run of the helicopter and while taxiing, when the main rotor thrust relieves considerably the helicopter landing gear thus putting the high-pressure shock strut out of operation.

Apart from its main function consisting in dampening lateral vibration, the low-pressure shock strut makes the landing gear "softer" thus improving the helicopter movement on the ground.

The high-pressure shock strut comprises outer tube 1, inner tube 14 with low-pressure shock strut outer tube 16 welded to it, needle 2, diffuser 3, piston ring 4, set of sealing collars 9, and other parts.

Attached to the lower portion of the high-pressure shock strut outer tube by means of arc welding is a part which is, essentially, a truncated cone provided with a needle holder. The cone terminates in a fork by means of which it is secured to the universal joint.

After welding and machining are completed, the outer and inner tubes are zinc-plated.

When moving inside the outer tube, the inner tube is guided by bronze bush 5 secured on the threaded portion of the inner tube and like bush 10 which braces the sealing pack with the aid of nut 11. The sealing pack consists of four leather collars, three rubber collars, and two duralumin distance rings 8.

Inserted into the inner groove of nut 11 is felt sealing gland 12 which serves to clean the surface of the inner tube from dust and dirt when the shock strut is in operation. The felt sealing gland is tightened up by nut 13. In a free state (under no load), the inner tube is held in place by spacing nut 6. When completely compressed, the inner tube rests with its shoulder against nut 13. Welded into the tapered portion of outer tube 1 is union 40 to which the pipeline running to the spring damper is connected.

The shock strut is filled with the AMF-10 hydraulic fluid through the charging union located in the lower portion of outer tube 16, screwed into which is standard charging valve 15. This valve serves for charging the shock strut with compressed commercial nitrogen.

On touch-down, the low-pressure shock strut is first completely compressed; then the outer tube of the high-pressure shock strut slides upward along the inner tube. In this case, the hydraulic fluid is forced out of the inner cavity of the outer tube into the inner cavity of the inner tube passing through the varying circular clearance between diffuser 3 and needle 2 and compressing the nitrogen in the working chamber of the inner tube. The circular space between the outer and inner tubes increases in length and is also filled with working fluid which displaces piston ring 4 and passes through the clearance formed by the lower portion of the bush and the inner diameter of the piston ring.

As the load is removed, the compressed nitrogen forces hydraulic fluid to leave the circular space and flow back into the inner cavity of the outer tube. The outer tube returns into the initial position slowly since, piston ring 4 being tightly pressed against the lower part of bush 5, fluid leaves the circular space only through the gap in the piston ring lock, which is 0.6 to 1 mm wide, and through four 2 mm-dia. holes 7 equispaced in inner tube 14.

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The reverse stroke braking valve is mounted in the shock strut high-pressure chamber "B" and serves as an additional means for eliminating lateral vibration of "ground resonance" type. The valve comprises valve proper (Ref. No.39), spring 38, cup 37, and guide 36.

The principle of valve operation is based on the difference in by-passing the AMT-10 hydraulic fluid through the special holes during the operating and reverse strokes of the inner tube.

The valve operates in the following way. During the operating stroke of inner tube 14, hydraulic fluid passes through the circular space between needle 2 and diffuser 3 and through eight 12 mm-dia. holes in guide 36 into the space under valve 39, thus pressing away spring 38 and shifting valve 39 upward to enter the high-pressure chamber.

During the reverse stroke, valve 39 is caused by spring 38 and hydraulic fluid pressure to move downward to close the eight 12 mm-dia. holes in guide 36. During the reverse stroke the hydraulic fluid flows through six holes 3.5 mm in diameter available in valve 39.

The complete stroke of the high-pressure shock strut outer tube is equal to 215 mm. The outer diameter of the inner tube is 200 mm, and inner diameter of the outer tube, 220 mm. The lower portion of outer tube 16 is provided with a partition which separates the high-pressure shock strut working section from the low-pressure shock strut.

The low-pressure shock strut comprises outer tube 16, inner tube 25, two bushes 17 and 21, diffuser 19, reverse stroke braking valve 39, and other parts. The shock strut is made pressure-tight by three round rubber rings 34 and two fluoroplastic rings 35 mounted in bush 21.

Inserted into the inner groove of nut 22 is felt sealing gland 33 whose function is identical with that of sealing gland 12 incorporated in the high-pressure shock strut.

When in a free state (under no load), the inner tube distance sleeve 20 rests against bush 21. When completely compressed, the inner tube shoulder comes up against bushing 24. Rubber ring 32 placed between bushing 24 and nut 22 serves to dampen the shocks. Bushing 24 is fixed in nut 22 by snap ring 23.

The low-pressure shock strut is filled with the AMT-10 hydraulic fluid through the charging union located in the upper part of the inner tube. Screwed into this union is standard charging valve 15. This valve serves for charging the shock strut with commercial nitrogen.

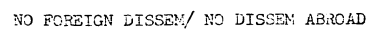
With the helicopter landing, the outer tube of the low-pressure shock strut slides over the inner tube upward. As a result, hydraulic fluid is forced out of the outer tube interior into the inner tube interior through one 10 mm-dia. hole drilled in diffuser 19, thus compressing the nitrogen trapped in the inner tube working chamber. Meanwhile, the circular space between the outer and inner tubes increases in length and is also filled with working fluid which presses off

valve 18 and flows further through the holes in lower bush 17 and through the circular clearance formed by the inner diameter of the outer tube and the outer diameter of the reverse stroke braking valve.

As the load is removed, nitrogen pressure in the inner tube causes hydraulic fluid to leave the circular space and flow back into the outer tube interior. The outer tube returns to its initial position slowly since valve 18 is tightly pressed to lower bush 17 and fluid is allowed to flow only

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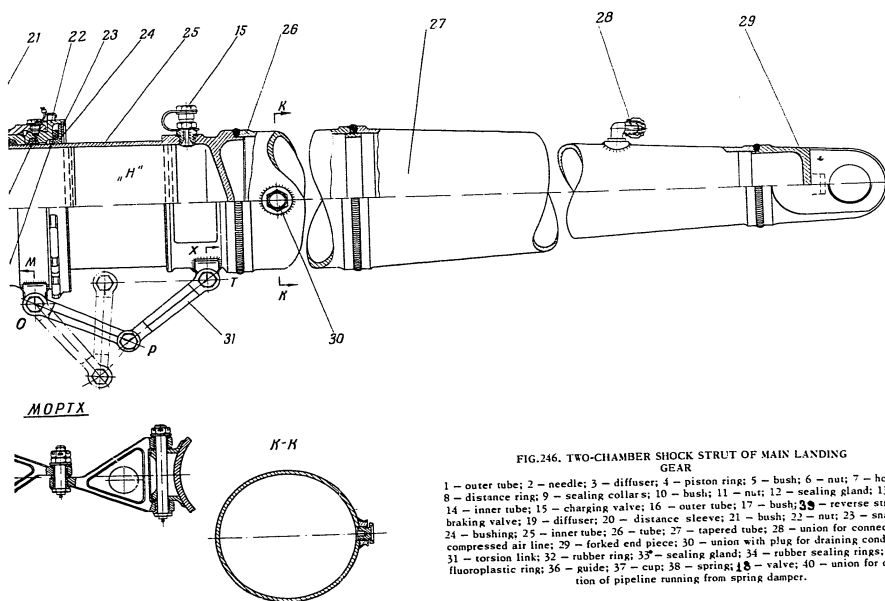


FIG. 246. TWO-CHAMBER SHOCK STRUT OF MAIN LANDING GEAR

1 - outer tube; 2 - needle; 3 - diffuser; 4 - piston ring; 5 - bush; 6 - nut; 7 - holes; 8 - distance ring; 9 - sealing collar; 10 - bush; 11 - nut; 12 - sealing gland; 13 - nut; 14 - inner tube; 15 - charging valve; 16 - outer tube; 17 - bush; 18 - reverse stroke braking valve; 19 - diffuser; 20 - distance sleeve; 21 - bush; 22 - nut; 23 - snap ring; 24 - bushing; 25 - inner tube; 26 - tube; 27 - tapered tube; 28 - union for connection of compressed air line; 29 - forked end piece; 30 - union with plug for draining condensate; 31 - torsion link; 32 - rubber ring; 33 - sealing gland; 34 - rubber sealing rings; 35 - fluoroplastic ring; 36 - guide; 37 - cup; 38 - spring; 39 - valve; 40 - union for connection of pipeline running from spring damper.

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through two 1.5 mm-dia. holes in valve 18, the holes in lower bush 17, and two 1.5 mm-dia. holes in inner tube 25. The upper portion of the inner tube is provided with a partition which separates the working section of the shock strut from the remaining shock strut space.

To prevent inner tube 25 from turning with respect to outer tube 16, use is made of torsion link 31 comprising two arms secured to tubes 16 and 25.

The inner spaces of elongation tubes 26 and tapered tubes 27 serve as compressed air reservoirs of the helicopter pneumatic system. Located in the lower part of tube 26 is union 30 with a plug which serves for draining condensate from the reservoir, and in the upper part of tapered tube 27, union 28 which serves for connecting the pneumatic system pipeline. The compressed air reservoirs are rated for a working pressure of 50 kg/sq.cm.

All the stress-carrying parts of the two-chamber shock strut are made from 30X1CA and 30X1CHA steel and heat-treated to $\sigma_B = 120 \pm 10$ kg/sq.mm and $\sigma_{\Sigma} = 170 \pm 10$ kg/sq.mm, respectively.

The inner surfaces of the outer tube are ground and honed, whereas its outer surfaces are machined and painted with grey enamel XB-16. The working surfaces of the inner tubes are polished and chrome-plated.

The outer surface of the shock strut is painted with grey enamel XB-16.

SPRING DAMPER

Spring damper 1 (Fig.247) is mounted on the stress-carrying elements of frame No.14 in the vicinity of the cargo compartment floor central hatch. The purpose of the damper is to eliminate helicopter lateral vibration of "ground resonance" type.

The damper has been so designed that its operation does not change the landing gear performance characteristics with the machine landed on both main wheels simultaneously (without any bank); at the same time, it considerably "softens" the landing during lateral vibration (swinging) of the helicopter.

The damper is secured to two riveted brackets 6 with the aid of two steel bands 2. Installed on the damper on special brackets 5 are two shut-off valves 4 which serve to disconnect the high-pressure shock strut working chambers from the working chambers of the spring damper when the shock struts are being charged with nitrogen. In all other cases, the shut-off valves must be placed in the open position and sealed.

Welded to both sides of the damper are unions 3 intended for letting out the air when the entire system is being filled with the AMT-10 hydraulic fluid.

The spring damper (Fig.248) comprises body 7, two springs 3, duralumin piston 9, round rubber sealing rings 2, 6, and 10, and a number of other parts.

Springs 3 are adjusted for an equal preliminary tension of 25 mm. The springs are guided by holders 4 fitted with rubber sealing ring 6, which is braced to body 7 by union nut 5, and by piston shank 8 held to piston 9 with six countersunk screws 11.

In case the helicopter is landed on one wheel, hydraulic fluid from the high-pressure shock strut (located on the side of the wheel that has touched the ground) flows under pressure along the pipeline through the shut-off valve into the damper to press the damper piston away until it rests against the face of holder 4, i.e. to a maximum distance which is equal to 175 mm. In its turn, the hydraulic fluid forced out of the other cavity of the damper flows through the shut-off valve and along the pipeline into the other high-pressure shock strut.

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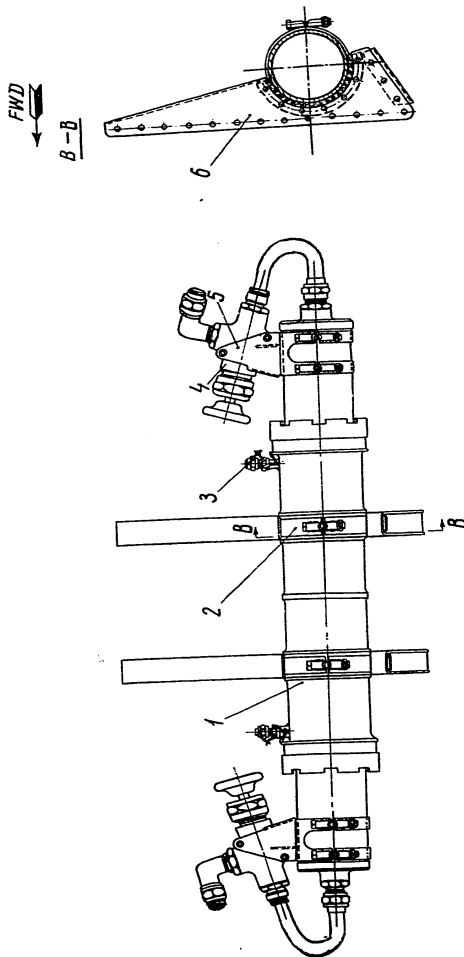


FIG. 247. INSTALLATION OF SPRING DAMPER ON FRAME N44
1 - spring damper; 2 - butt; 3 - union; 4 - shut-off valve; 5 - shut-off valve attachment bracket; 6 - spring damper attachment bracket.

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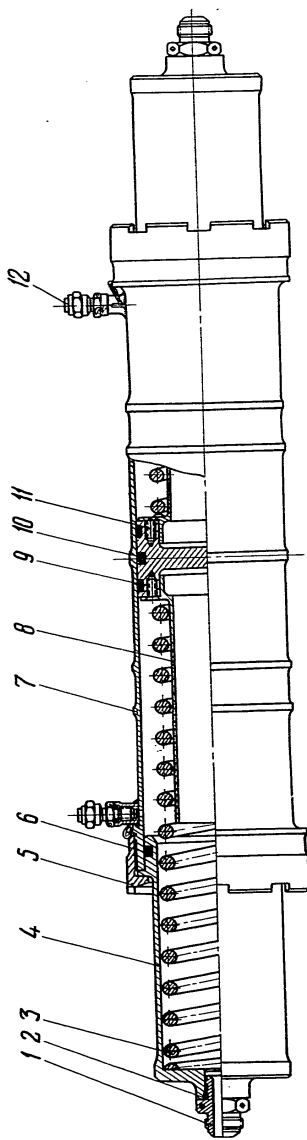


FIG.248. SPRING DAMPER
 1 - union; 2 - sealing ring; 3 - spring; 4 - spring holder; 5 - union nut; 6 - sealing ring; 7 - damper body; 8 - piston shank; 9 - piston; 10 - sealing ring; 11 - screw; 12 - union with plug for air release from system.

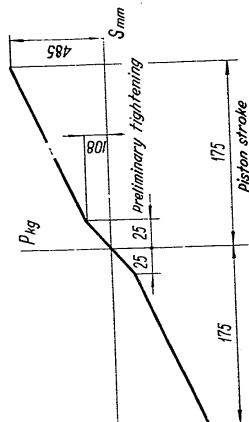


FIG.249. SPRING DAMPER PERFORMANCE CHARACTERISTICS.

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With the helicopter parked on a level ground, the piston should be in the middle position as indicated in Fig.248.

The performance characteristics of the spring damper are presented in Fig.249.

MAIN LANDING GEAR WHEELS

The main landing gear wheel (Fig.250) is a braking wheel, 1325 x 480A in size, employing arched tyres. The brake used with the wheel is of the one-side compressed air chamber type.

Wheel drum 5 has detachable flange 1 which is secured to the drum by two locking half-rings 2. Both the drum and the detachable flange are made from magnesium alloy.

The wheel drum carries braking jacket 3 held to it with bolts 6 and centred with respect to the roller bearing axis by the recess made on the drum face. Pressed into the special seats in the drum are two radial thrust roller bearings by means of which the wheel is mounted on the landing gear axle shaft. The outer sides of the roller bearings are protected with felt sealing glands 7 which prevent penetration of dust and dirt inside the bearings.

The wheel brake is composed of body 8, braking chambers 10, and friction plates 4.

Arranged over the circumference between the brake body sides are the braking chambers formed by two flat closed rubber tubes with valves 9 for supply of compressed air from the helicopter braking system; the valves are secured to the brake body. The compressed air supplied from the helicopter braking system causes the braking chambers to expand; the latter press the friction plates to the surface of the braking jacket.

The wheel brake is attached to the axle shaft flange with twelve bolts 1 (Fig.242). The brake is centred with relation to the wheel (braking jacket) by means of the centring rim on the landing gear axle.

The wheel is held on the axle shaft with nut 2 (see Fig.242) by means of flange 3 whose slots are meshed with the projections machined on the face of axle shaft 7; the flange is thrust against the inner race of the roller bearing. Flange 3 prevents nut 2 from rotation which may occur due to rotation of the wheel. The axial and radial play of the wheel are adjusted with the help of nut 2.

The initial pressure in the wheel tyre tube is 7 kg/sq.cm. The pressure in the braking chamber depends on the length of the stroke of the HY-7 valve pusher, but it must be borne in mind that the maximum pressure in the chamber created by the brake control valve (debooster) is equal to 13.5 kg/sq.cm.

NOSE LANDING GEAR STRUT

The nose landing gear strut (Fig.251) is secured with the aid of two attachment units, mounted on frame No.1 of the fuselage central part, and comprises outer tube 1, inner tube 5, axle 4 with two wheels, and attachment units 2. The wheels along with the shock strut inner tube are of the castoring type. The wheels are free to rotate together with the axle in roller bearings pressed into the shoe which is fitted on the lower portion of the inner tube.

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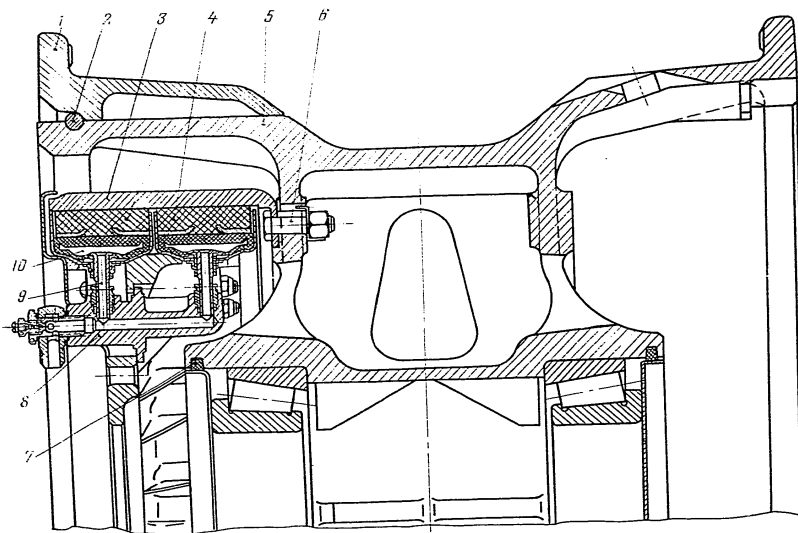


FIG.250. MAIN LANDING GEAR WHEEL

1 - detachable flange; 2 - locking half-ring; 3 - braking jacket; 4 - friction plates; 5 - wheel drum; 6 - bolt; 7 - felt sealing gland; 8 - body; 9 - valve; 10 - braking chamber.

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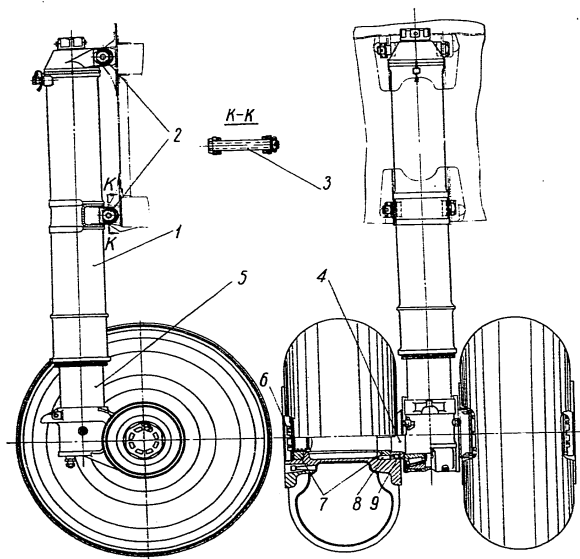


FIG.251. NOSE LANDING GEAR STRUT WITH WHEELS

1 - outer tube; 2 - attachment units; 3 - bolt; 4 - axle with wheels; 5 - inner tube; 6 - nut; 7 and 9 - bushings; 8 - pin.

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The wheels are a non-braking type, 720 x 310 in size, with arched tyres.

The shock strut outer tube is fastened to the attachment units on the fuselage with two 30XICA steel bolts 3 and castellated nuts which are locked with cotter pins. The bolts are finished in accordance with plain quality requirements, heat-treated to $\sigma_b = 120 \pm 10$ kg/sq.mm, and cadmium-plated.

The nose shock strut (Fig.252) comprises outer tube 3 with steel cover 2 made fast on its upper part by electric arc welding. The cover has a fork through which the outer tube is secured to the fuselage and an inner bushing for plunger 4. The plunger is fixed in the axial direction by nut 1 which also tightens up the rubber sealing ring. The lower part of the plunger, along with the piston ring fitted on it, is centred to slide inside the inner tube during the shock strut operation.

Welded to the outer tube middle is a special fork which serves as a second attachment unit securing the outer tube to the fuselage. Inserted into the outer tube from below is steel inner tube 7 with adapter 8 press-fitted into it. The adapter is meant for the attachment of the axle together with the wheels. To safeguard the adapter against turning about the inner tube axis, it is fixed in place by two tapered bushings 10 braced by bolt 11.

Press-fitted into the adapter are two roller bearings 9. The felt sealing rings arranged on the adapter faces keep dirt out of the bearings. The adapter is also provided with a spherical seat for the screw jack.

Wheel axle 4 (Fig.251) is free to rotate in the adapter in the roller bearings.

Shaped needle 5 (Fig.252) is screwed into, and centred in, the inner tube with the help of aluminum adapter piston 12. During operation of the shock strut, the inner tube is guided inside the outer tube by lower bush 15 and upper bush 21 threaded to the inner tube. Both bushes are fabricated from bronze. Bush 15 braces up the sealing pack with the help of nut 14. The pack consists of three leather collars, two rubber collars, and two distance rings 16 made from duralumin.

The inner groove of nut 14 receives felt sealing gland 6 which serves to clean the inner tube surface of dirt and dust during operation of the shock strut. The gland is tightened with nut 13. The sealing pack is thrust against nut 17 tightening up lower retainer 19 of the cam mechanism.

The cam mechanism with retainers 19 and 20 is intended for wheel casting in the direction of flight. Lower retainer 19 is secured in the outer tube by eight locating pins 18 equispaced over the circumference, whereas the upper retainer is splined to the inner tube. In a free state (under no load) the inner tube is fixed by the cam mechanism. When completely compressed, the face of adapter 8 of the inner tube rests against nut 13.

The shock strut is filled with the AMT-10 hydraulic fluid through the charging union located in the upper part of the outer tube; screwed into this union is standard charging valve 23. The fluid enters the outer tube, the inside of the inner tube, and the circular space between the outer and inner tubes. This done, the shock strut is charged with compressed commercial nitrogen through charging valve 23.

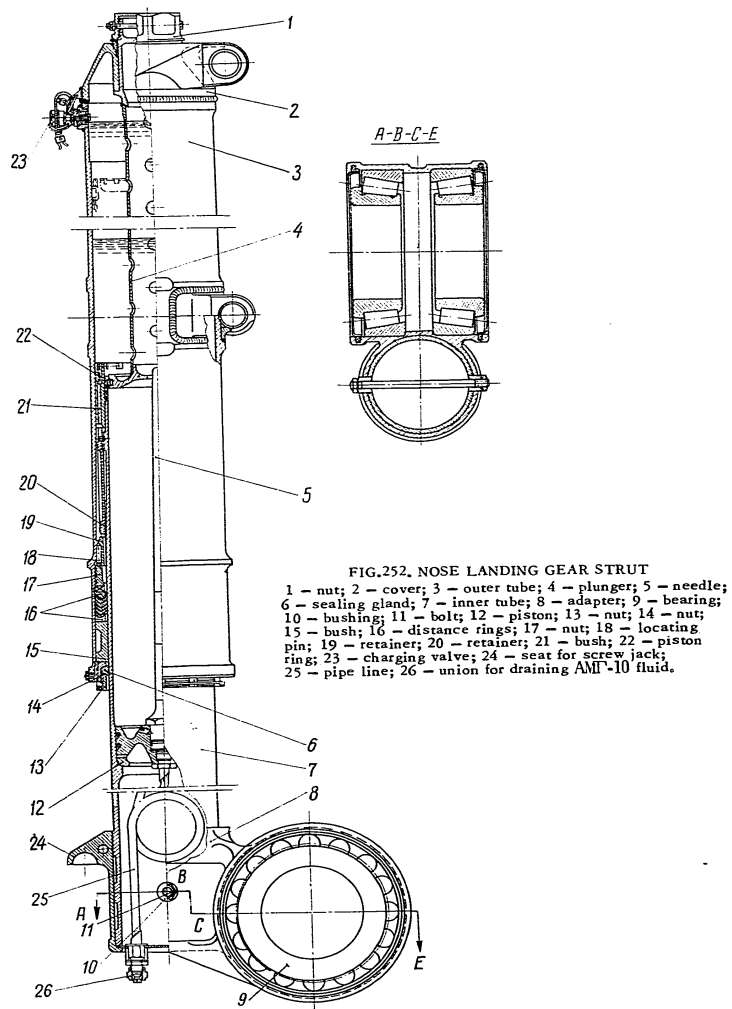
During direct stroke (as the helicopter knocks against the ground), the motion of the shock strut is slowed down due to the overflow of the hydraulic fluid through the varying circular clearance between the diffuser of plunger 4 and needle 5, and due to the compression of nitrogen in the outer tube working chamber. The circular space between the outer and inner tubes increases in length and gets also filled with hydraulic fluid which presses off piston ring 22 and passes through the

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clearance, formed by the upper portion of the bush and the outer tube inner diameter, and through thirty-six 4 mm-dia. holes equispaced over the circumference of the bush upper part.

During the reverse stroke, compressed nitrogen in the outer tube forces hydraulic fluid out of the circular space back into the inner tube interior. The inner tube returns to its initial position somewhat slower since piston ring 22 is a tight fit on the upper part of bush 21, and fluid is allowed to flow only through twelve holes 1.8 mm in diameter.

Arranged in the lower portion of inner tube 7 is a union for draining the AMT-10 fluid along pipeline 25. This union permits draining hydraulic fluid from the strut without removal of the latter from the helicopter.

The complete stroke of the shock strut is equal to 429 mm. The inner tube outer diameter is 125 mm; the inner diameter of the outer tube is 140 mm.

All the main stress-carrying elements of the nose landing gear strut are made from 30X1CA and 30X1CHA steel and heat-treated to $\sigma_B = 120 \pm 10$ kg/sq.mm and $\sigma_B = 170 \pm 10$ kg/sq.mm, respectively.

The parts are zinc-plated all over except for locating surfaces. The outer tube interior is ground and honed, whereas the outer surface is machined and painted with grey enamel XB-16. The working surface of the inner tube is polished and chrome-plated, and the non-machined parts are coated with grey enamel.

NOSE LANDING GEAR WHEELS

The nose landing gear wheels (Fig.251) are a non-braking type, 720 x 310 in size, with arched tyres.

The wheel comprises a drum, a tube, a tyre and other parts. The wheel drum has a detachable flange secured to it with two locking half-rings preventing axial displacement of the flange.

The wheels are axle-mounted on both sides of the nose strut and are braced by nuts 6 to the roller bearing inner races with the aid of bushings 7 and 9. Inner bushing 7 is fixed by pins 8 to the drum to prevent the wheels from turning about the axle. The wheels are rigidly secured to the common axle and run in two roller bearings inserted into the shock strut adapter. Such arrangement of the wheels eliminates vibration of the "shimmy" type.

The wheel tyre tube is charged through a nipple to an initial pressure of 6 kg/sq.cm.

TAIL BUMPER

The tail bumper (Fig.253) is made up of shock strut 9 hinged to the fin beam spar, two tubular brace struts 12 secured to the attachment fittings of two fin beam stringers No.12, and cast magnesium step bearing plate 10.

The brace struts are fabricated from 30X1CA steel tubes 45 x 42 mm in section. Welded to the upper ends of the brace struts are steel sleeves 1 accommodating the rubber dampers. Each damper is composed of two hollow steel cylinders, one fitted onto the other, with a rubber shell cured into the 6-mm clearance between the cylinder walls.

Inserted into the damper is eye bolt 5 which serves for securing the brace strut to the attachment fitting on the fin beam. The eye bolt is tightened in the

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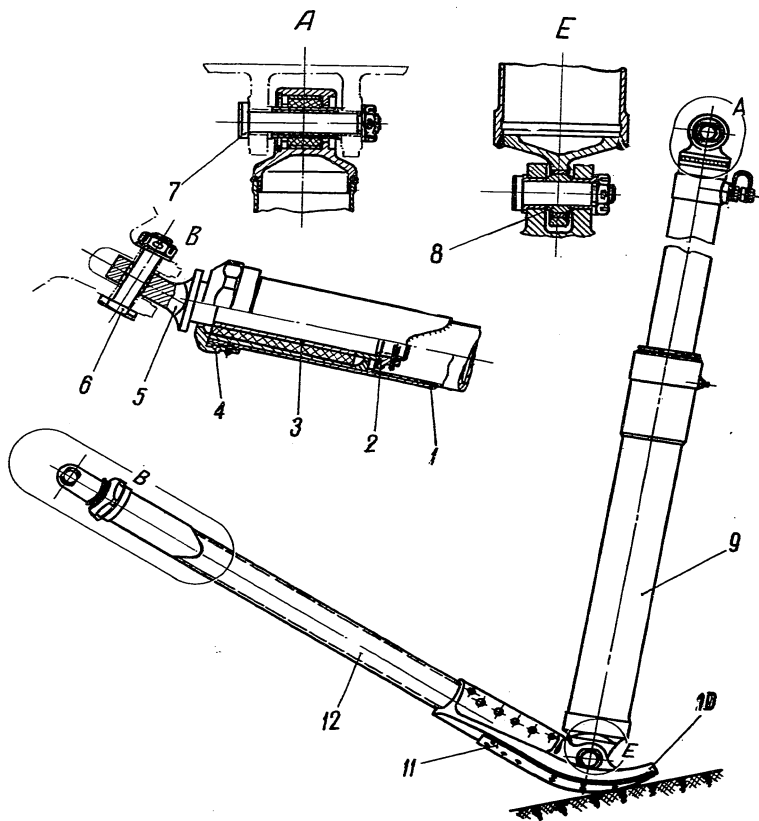


FIG. 253. TAIL BUMPER

A - shock strut inner tube-to-fin beam spar attachment fitting
 B - brace strut-to-fin beam attachment fitting
 E - shock strut-to-bearing plate attachment fitting
 1 - sleeve; 2 - nut; 3 - distance sleeve; 4 - nut; 5 - eye bolt; 6 and 7 - bolts; 8 - spherical bearing; 9 - shock strut; 10 - magnesium bearing plate; 11 - steel plate; 12 - brace strut.

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axial direction with nut 2 by means of distance sleeve 3. Thus assembled, the damper is inserted into its housing on the brace strut and tightened up by nut 4. The rubber dampers used in the brace struts serve to protect the hinge connections against excessive wear and play.

The brace struts are fastened to the attachment fittings on the pylon with steel bolts 6 located so as to form one line in the horizontal plane. This method of attachment makes it possible for the brace struts to turn during operation of the shock strut. The brace strut opposite ends are inserted into the holes of bearing plate 1 and riveted to the latter (Fig. 254).

The magnesium bearing plate is fitted with attachment fork E (see Fig. 253) which serves to secure the outer tube of shock strut 9 with the help of a spherical bearing. The bearing plate is protected against wear by steel plate 11 riveted to its bottom.

The upper part of the shock strut inner tube is held to the attachment fitting on the fin beam spar by steel bolt 7. The shock strut attachment fitting is also provided with a rubber damper whose function is similar to that of the brace strut dampers.

The brace struts and bolts are made from 30XICA steel and heat-treated to $\sigma_B = 120 \pm 10$ kg/sq.mm. The brace struts are zinc-plated, and the bolts, cadmium-plated.

The magnesium bearing plate is also subjected to heat-treatment and provided with an anticorrosive coating.

The tail bumper shock strut (Fig. 255) comprises outer tube 5 with eye cup 6 welded to it (the cup serves for attachment of the shock strut to the tail bumper bearing plate), inner tube 1 with damper housing 14 welded to its upper part (the damper housing also serves for the shock strut-to-fin beam attachment), diffuser 7 screwed onto the inner tube, two bushes 8 and 10 (bush 10 being used as a holder for four round rubber sealing rings 9), felt ring 3, and a number of minor parts.

Used as a guide for the inner tube when it moves in the outer one, is lower bush 8, held to the inner tube by four threaded pins 4, and upper bush 10 secured in the outer tube by nut 11 with the aid of bushing 12. Placed between the nut and the bushing is felt sealing gland 2 intended for cleaning the inner tube of dust and dirt.

With no load applied, inner tube diffuser 7 rests against the upper bush. The inner tube being completely depressed, diffuser 7 comes up against the shoulder of eye cup 6 on the shock strut outer tube.

The shock strut is filled with the AMP-10 hydraulic fluid through the charging union located in the inner tube upper portion; screwed into this union is standard charging valve 13 used for charging the shock strut with compressed commercial nitrogen.

As the tail bumper bearing plate knocks against the ground, the shock strut outer tube slides upward along the inner tube thus forcing hydraulic fluid from the outer tube interior into the gas cavity of the inner tube. The fluid passes through diffuser 7 and compresses the nitrogen trapped in the working chamber of the inner tube. The circular space between the outer and inner tubes increases in length and is also filled with fluid which passes through four radial holes made in the inner tube wall.

With the load removed, compressed nitrogen in the inner tube forces hydraulic fluid to leave the circular space along the same ducts.

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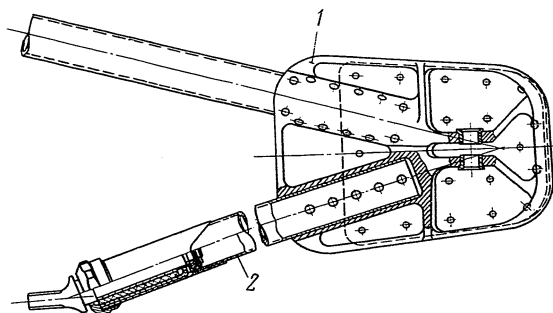


FIG. 254. BRACE STRUT-TO-BEARING PLATE ATTACHMENT
1 - magnesium bearing plate; 2 - brace strut.

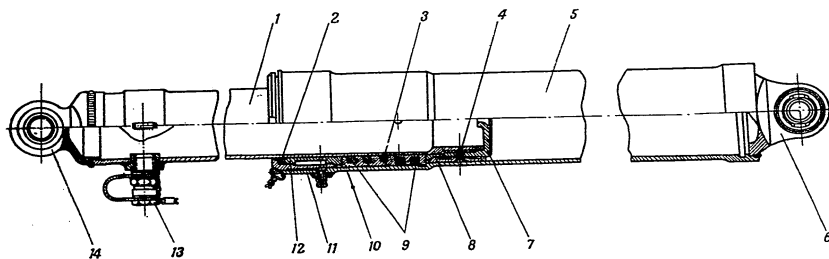


FIG. 255. TAIL BUMPER SHOCK STRUT
1 - inner tube; 2 - sealing gland; 3 - felt ring; 4 - pin; 5 - outer tube; 6 - eye cup;
7 - diffuser; 8 - bush; 9 - sealing rings; 10 - bush; 11 - nut; 12 - bushing; 13 - charging valve; 14 - damper housing.

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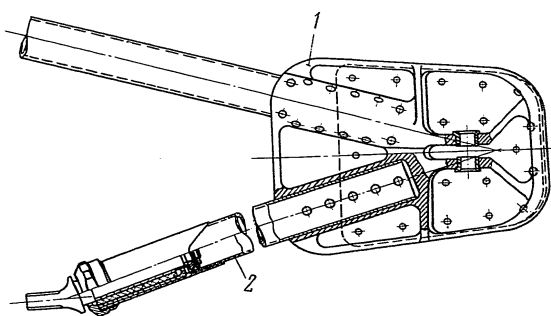


FIG. 254. BRACE STRUT-TO-BEARING PLATE ATTACHMENT
1 - magnesium bearing plate; 2 - brace strut.

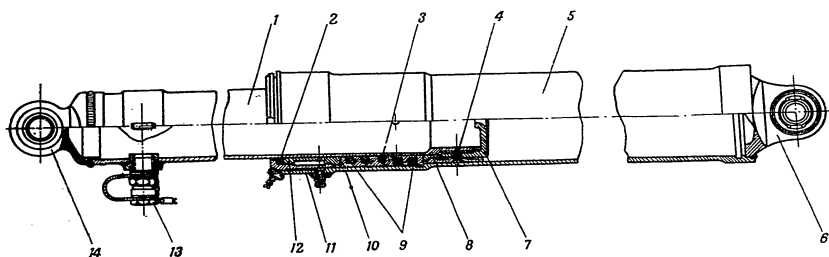


FIG. 255. TAIL BUMPER SHOCK STRUT
1 - inner tube; 2 - sealing gland; 3 - felt ring; 4 - pin; 5 - outer tube; 6 - eye cup;
7 - diffuser; 8 - bush; 9 - seal ring; 10 - bush; 11 - nut; 12 - bushing; 13 - charging valve; 14 - damper housing.

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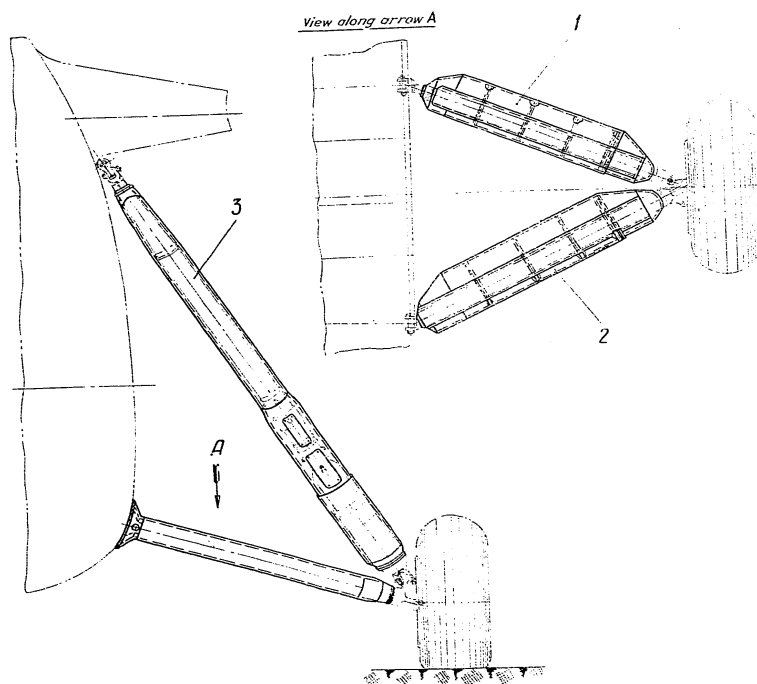
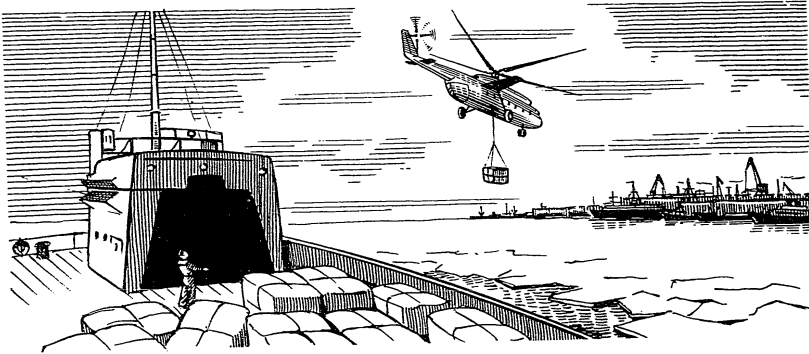


FIG. 256. MAIN LANDING GEAR FAIRINGS
1 - brace strut fairing; 2 - axle shaft fairing; 3 - two-chamber shock strut fairing.

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Chapter X

HYDRAULIC SYSTEM

GENERAL

The helicopter hydraulic system comprises the main, duplicating, and auxiliary systems.

The main and duplicating systems are designed for feeding hydraulic fluid into hydraulic boosters 12 and 14 (Fig. 257), incorporated in the helicopter control system, and hydraulic mechanism 17 controlling the wing position.

The auxiliary system provides for operation of the windshield wipers, the collective pitch-throttle control lever friction clutch, the cylinders serving for adjustment of the pilots' seats with regard to height and back-rest tilt, the sling system lock actuating cylinder, and the cylinder controlling the fan adjustable blades.

When the helicopter is parked, the auxiliary system serves for feeding hydraulic fluid into the hydraulic mechanisms and cylinders actuating the cargo compartment door panels and loading ramps, as well as the cowl servicing platforms.

The pumps incorporated in the main, duplicating, and auxiliary hydraulic systems are mounted on the drives of the main gear box, which allows normal operation of the systems in the event the engines fail, and the helicopter main rotor changes over to autorotation.

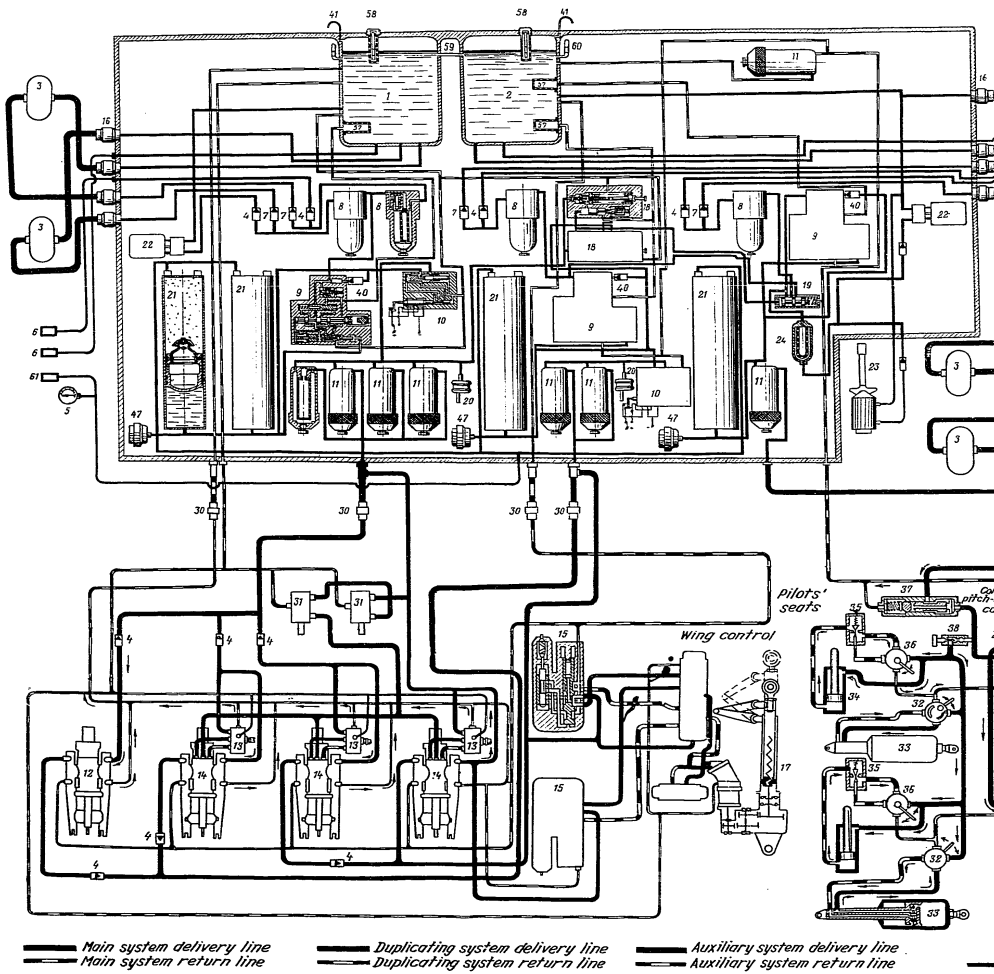
The majority of the principal units employed by the main, duplicating, and auxiliary hydraulic systems along with the hydraulic accumulators and hydraulic reservoirs form hydraulic assembly 1B-I which is installed in the gear box compartment in the vicinity of the pumps and hydraulic boosters. This provides for ease of the hydraulic system mounting and employment of the shortest possible pipelines.

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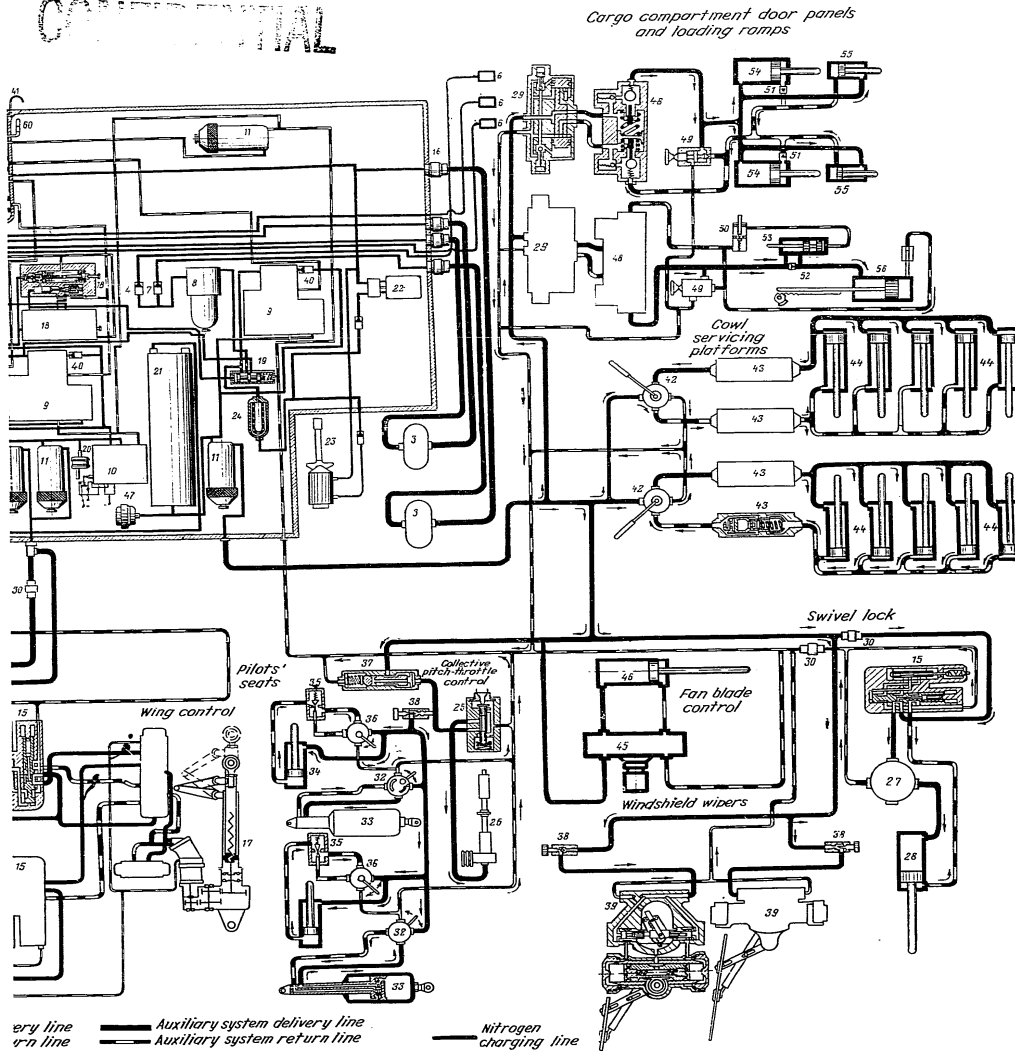


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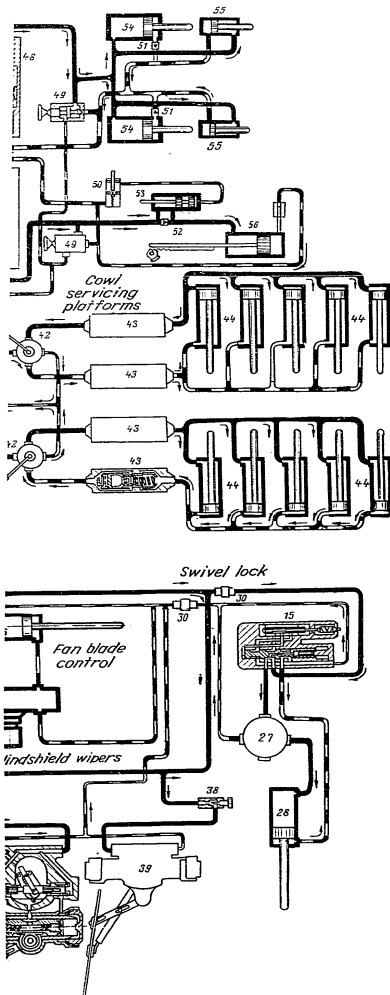
compartment door panels
and loading ramps

FIG.257. SCHEMATIC DIAGRAM OF HELICOPTER HYDRAULIC SYSTEM

1 - main hydraulic system reservoir; 2 - duplicating and auxiliary hydraulic system reservoir; 3 - counterclockwise gear-type pump H112C; 4 - non-return valve OK-10; 5 - pressure gauge for charging hydraulic accumulators with nitrogen when on ground; 6 - ground supply hydraulic union; 7 - non-return valve; 8 - coarse filter; 9 - pump unloading unit ΓA-77MH; 10 - solenoid controlled hydraulic valve ΓA-74M/7; 11 - fine filter; 12 - hydraulic booster BY-32A; 13 - control unit AV-33E; 14 - hydraulic booster BV-33A; 15 - solenoid-controlled hydraulic valve ΓA-21M/9; 16 - disconnect valve; 17 - wing control mechanism ΓMK-1; 18 - change-over unit ΓA-255; 19 - change-over slide valve; 20 - pressure warning unit C/190A; 21 - hydraulic accumulator; 22 - electric pump 465M; 23 - hand pump HP-01; 24 - coarse filter; 25 - solenoid-controlled hydraulic valve ΓA-192; 26 - collective pitch-throttle control lever (with control button); 27 - hand cock for emergency release of sling system swivel lock; 28 - swivel lock actuating cylinder; 29 - solenoid-operated valve ΓA-185 controlling loading ramps and cargo compartment door panels; 30 - disconnect valve; 31 - autopilot solenoid-operated control valve ΓA-192; 32 - pilot's seat back-rest tilt control valve; 33 - seat back-rest tilting cylinder; 34 - pilot's seat raising cylinder; 35 - seat locking valve; 36 - seat raising control valve; 37 - reducing valve ΓA-169-00/5; 38 - throttle valve ΓA-230; 39 - windshield wiper ΓA-211; 40 - non-return valve OK-16; 41 - hydraulic reservoir vent pipes; 42 - cowl servicing platform hand control valve; 43 - metering valve ΓA-175; 44 - cowl servicing platform actuating cylinder; 45 - solenoid-controlled hydraulic valve ΓA-163; 46 - fan adjustable blade actuating cylinder; 47 - D/M-240 pressure gauge electric transmitter; 48 - loading ramp two-way hydraulic lock ΓA-88/6; 49 - valve for manual opening of cargo compartment door panels and loading ramps; 50 - lever-operated valve ΓA-36; 51 - corrected non-return valve OK-4 (one-way flow restrictor); 52 - non-return valve OK-4; 53 - cargo compartment door panel lock actuating cylinder; 54 - main loading ramp actuating cylinder; 55 - end loading ramp actuating cylinder; 56 - cargo compartment door panel actuating cylinder; 57 - gauze filter (foam damper); 58 - hydraulic reservoir filler; 59 - hydraulic reservoir connecting pipe; 60 - hydraulic fluid level indicator; 61 - union for charging hydraulic accumulators with nitrogen when on ground.

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The pipelines connecting pumps H112C with hydraulic assembly IB-I are made up of flexible hoses which are more reliable when exposed to vibration than pipelines employing steel piping.

By reference to the schematic diagram of the helicopter hydraulic system (Fig.257), it will be seen that all the hydraulic units making up the hydraulic assembly are encircled by a common shaded line.

The two hydraulic reservoirs incorporated in the hydraulic assembly feed hydraulic fluid into the main and duplicating systems, respectively. The auxiliary system draws fluid from the upper part of the duplicating system reservoir.

Each hydraulic system includes: pump H112C, a hydraulic accumulator (the main system incorporating two pumps and two hydraulic accumulators), pump unloading unit IA-77MH with a safety valve, coarse filters, fine filters, electric pressure gauge J11M-240, and other units.

The hydraulic system provides for duplicating the operation of all units and pipelines incorporated in the main system by the units and pipelines of the duplicating system, except for the pipeline and control unit AV-33E of the autopilot which is operated by the main system only.

The pipelines of the main and duplicating systems are led to hydraulic boosters EV-32A, EV-33A, and to hydraulic wing control mechanism IMK-I. Each hydraulic booster is made up of two independent hydraulic boosters employing a common actuating rod and a common cylinder that is divided into two operating chambers; these are supplied with fluid from the main and duplicating systems, respectively.

Hydraulic mechanism IMK-I controlling the wing position is also supplied from the main or duplicating system via valves IA-21M/9 (depending on which of the systems is capable of supplying working pressure). This pressure is cut in automatically by the hydraulic mechanism slide valve, causing fluid to flow right into the hydraulic motor.

Connected in series into the duplicating system are two change-over units IA-255 which operate as soon as pressure drops in the main system to put the duplicating system in operation.

When the hydraulic boosters start running from the duplicating system, the hydraulic assembly change-over slide valve operates to cause the auxiliary system pump to feed hydraulic fluid into the duplicating system. Should it be necessary to increase pressure in the auxiliary system, electric pump 465M is started by a switch mounted on the flight engineer's control panel.

Control units IA-255 and the change-over slide valve are connected by a pipeline with the main hydraulic system and, with the main system functioning normally, provide for idle running of the duplicating system pump (draining fluid into the reservoir) and for normal operation of the auxiliary system.

The hydraulic system uses non-freezing fluid AMT-10 at a working pressure of 120 to 155 kg/sq.cm, within ambient air temperature range of +60 to -50°C.

The hydraulic accumulators of the main and duplicating systems are charged with commercial nitrogen to a pressure of 85 kg/sq.cm (with zero pressure in the hydraulic system). The hydraulic accumulator of the auxiliary system is charged with commercial nitrogen to 30 kg/sq.cm, which adds up to the amount of fluid accumulated in the system.

Charging of the four hydraulic accumulators with nitrogen is accomplished simultaneously via the helicopter charging union to which a ground commercial

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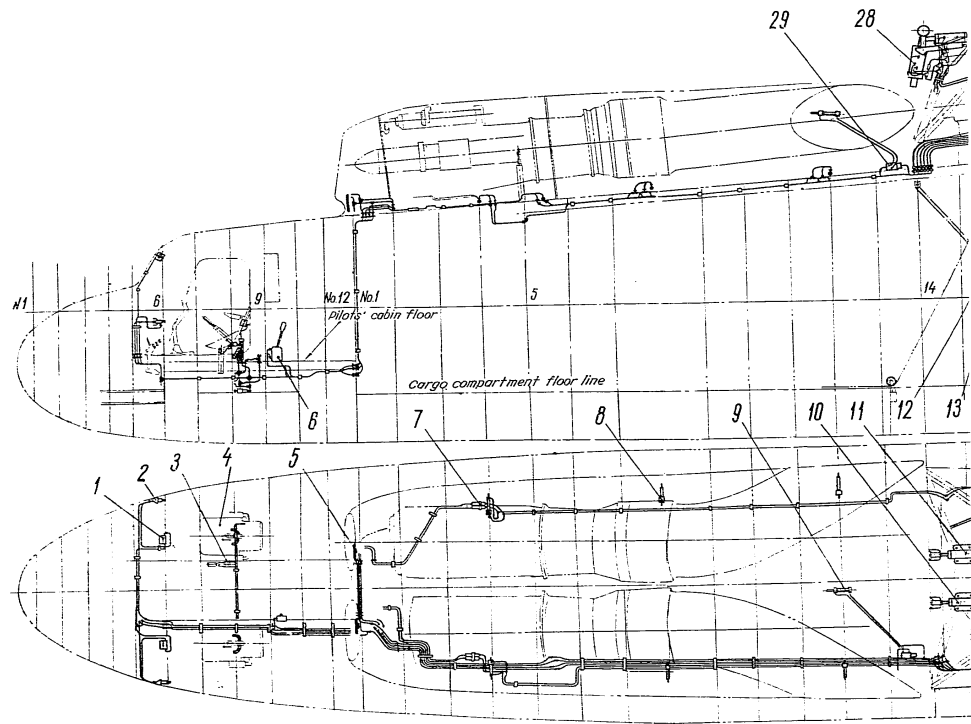


FIG.258. DIAGRAM SHOWING ARRANGEMENT OF MAIN

1 - windshield wiper ΓA-211; 2 - throttle valve ΓA-230 controlling windshield wiper; 3 - collective pitch-throttle control lever; 4 - pilot's seat with hydraulic height and back-rest tilt control; 5 - cowl servicing platform control panel; 6 - hand pump HP-01; 7 - metering valve ΓA-175; 8 - engine compartment cowl platform actuating cylinder; 9 - fan adjustable blade actuating cylinder; 10 - lateral control hydraulic booster BY-33A; 11 - longitudinal control hydraulic booster BY-33A; 12 - sling system lock release cylinder; 13 - solenoid-operated valve ΓA-21M/9 controlling sling system lock; 14 - actuating cylinder of gear box compartment cowl servicing platform; 15 - foot control system hydraulic booster BY-33A; 16 - ground supply panel; 17 - wing hydraulic control mechanism ΓMK-1;

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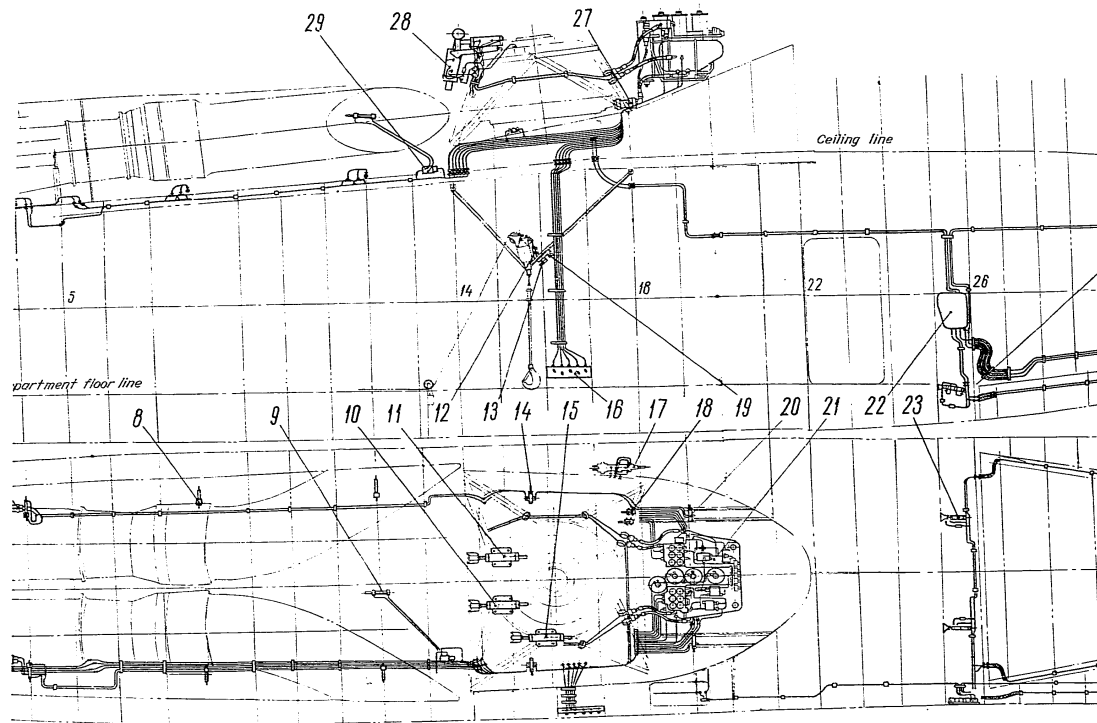


FIG.258. DIAGRAM SHOWING ARRANGEMENT OF MAIN HYDRAULIC SYSTEM UNITS ON HELICOPTER

1 - GA-211; 2 - throttle valve GA-230 controlling windshield
e pitch-throttle control lever; 4 - pilot's seat with hydraulic
: tilt control; 5 - cowl servicing platform control panel;
11; 7 - metering valve GA-175; 8 - engine compart-
actuating cylinder; 9 - fan adjustable blade actuating cylinder;
hydraulic booster EV-33A; 11 - longitudinal control hydraulic
- sling system lock release cylinder; 13 - solenoid-operated
trolling sling system lock; 14 - actuating cylinder of gear box
servicing platform; 15 - foot control system hydraulic booster
l supply panel; 17 - wing hydraulic control mechanism FMK-1;

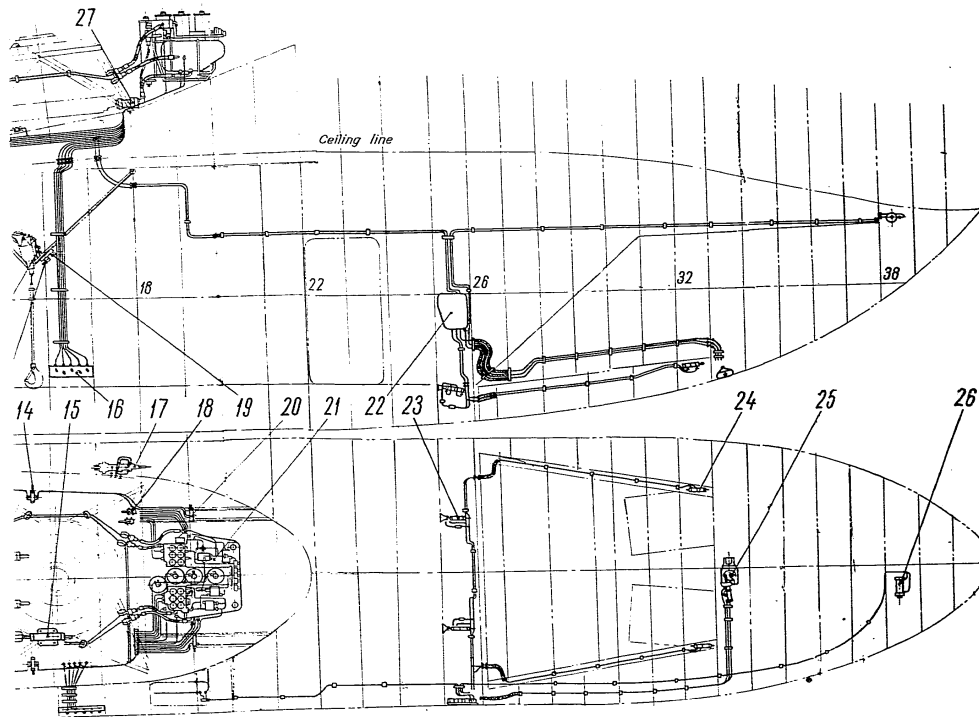
18 - FMK-1 hydraulic mechanism electric control valve GA-21M/9; 19 - hand
for cargo emergency jettisoning from sling system; 20 - hydraulic assembly
servicing platform actuating cylinder; 21 - hydraulic assembly; 22 - cargo
compartment door and loading ramp control panel; 23 - cylinder for lowering ar
raising main loading ramp; 24 - cylinder for lowering and raising end loading r
25 - cargo compartment door panel lock; 26 - cylinder for opening and closing
cargo compartment door panels; 27 - pump H 112C; 28 - main rotor collective
pitch control hydraulic booster EV-32A; 29 - solenoid-operated hydraulic valve
GA-163 controlling fan adjustable blade actuating cylinder.

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HYDRAULIC SYSTEM UNITS ON HELICOPTER

18 - ГМК-1 hydraulic mechanism electric control valve ГА-21М/9; 19 - hand valve for cargo emergency jettisoning from sling system; 20 - hydraulic assembly servicing platform actuating cylinder; 21 - hydraulic assembly; 22 - cargo compartment door and loading ramp control panel; 23 - cylinder for lowering and raising main loading ramp; 24 - cylinder for lowering and raising end loading ramp; 25 - cargo compartment door panel lock; 26 - cylinder for opening and closing cargo compartment door panels; 27 - pump H IIIEC; 28 - main rotor collective pitch control hydraulic booster БУ-32А; 29 - solenoid-operated hydraulic valve ГА-163 controlling fan adjustable blade actuating cylinder.

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nitrogen bottle is connected by means of a hose contained in the ground equipment set. The charging completed, pressure from the auxiliary system hydraulic accumulator is bled to 30 kg/sq.cm through use of a special appliance. Pressure in the hydraulic accumulators is checked by the readings of the pressure gauge mounted on the above-mentioned appliance.

Hydraulic fluid is delivered into the system through the reservoir fillers enclosing gauze filters or through helicopter suction unions incorporated in the duplicating or main system.

Arranged outboard at the fuselage port side, between frames Nos 16 and 17, is a panel mounting five disconnect valves for connection of the hoses running from a ground hydraulic unit which is employed for checking the hydraulic system on the ground with the main rotor at a standstill. Three of the unions are designed for connection to the delivery line, and two, for connection to the suction line, thus making it possible to connect and check operation of the helicopter main, duplicating, and auxiliary systems when run from the ground hydraulic unit.

The hydraulic system pipelines are constructed of rigid piping, flexible hoses, and fittings, the joints being sealed by paste MTC. The helicopter hydraulic system and hydraulic assembly employ disconnect valves which allow quick manual disconnection of the pipelines from the hydraulic units, thereby preventing hydraulic fluid flow from the disconnected pipelines during dismantling and installation of the pumps and hydraulic boosters.

Fig.258 illustrates arrangement of the hydraulic system units on the helicopter.

Hydraulic System Basic Specifications

Hydraulic fluid	AMF-IO, State Standard IOCT 6794-53
Working pressure in each system	120 ± 5 to 155 ± 5 kg/sq.cm
Ambient air temperature range within which hydraulic system is capable of normal operation	from -50° to +60°C
Permissible temperature of hydraulic fluid	up to +85°C
Amount of fluid poured into hydraulic reservoirs:	
main system	40 to 45 lit
duplicating and auxiliary systems	40 to 45 lit
Pressure in system at which pump starts feeding fluid into hydraulic system (operating duty)	120 ± 5 kg/sq.cm
Pressure in system at which pump starts returning fluid into reservoir (idling duty)	155 ± 5 kg/sq.cm
Minimum pressure in main system at which hydraulic boosters are changed for supply over to duplicating system and auxiliary system pump starts feeding fluid into duplicating system	75 ± 5 kg/sq.cm

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Pressure in main system at which
hydraulic boosters are changed for
supply from duplicating system over
to main system and auxiliary system
pump is disconnected from duplicating
system 100 $\pm$ 10 kg/sq.cm

Filtering capacity:

coarse filter 80 μ

fine filter 12 μ

Total amount of fluid in hydraulic system 120 lit, approx.

Weight of dry hydraulic assembly 235 kg, approx.

MAIN HYDRAULIC SYSTEM

Hydraulic fluid from reservoir 1 (Fig.257) is drawn via the pipeline and disconnect valves 16 by two counterclockwise pumps HM2C (Ref.No.3). Disconnect valves 16 allow replacement of the pumps without draining fluid from reservoir 1. Pumps 3 are actuated by means of a special drive provided at the main gear box rear. From two pumps 3 hydraulic fluid flows via non-return valves 7 and filters 8 to pump unloading unit 9. Non-return valves 7 prevent hydraulic fluid against flowing back into the reservoir through pumps HM2C when the hydraulic system is being checked with use made of the ground hydraulic unit.

The function of pump unloading unit 9 is to maintain pressure within 120 $\pm$ 5 to 155 $\pm$ 5 kg/sq.cm. As soon as pressure is built up to reach 155 kg/sq.cm, the unloading unit will switch the pumps over to delivering hydraulic fluid back into the reservoir at zero pressure; in case pressure drops down to 120 kg/sq.cm, the unloading unit will cause pumps 3 to feed fluid into the hydraulic system. From unloading unit 9, fluid is carried through non-return valve 40 into two hydraulic accumulators 21 and valve 10 remotely controlled by a solenoid.

The fluid entering the hydraulic accumulators compresses the nitrogen; when pressure reaches 155 kg/sq.cm, pump unloading unit 9 operates, thereby starting to by-pass hydraulic fluid into the reservoir. While pressure in the hydraulic accumulators is dropping off from 155 to 120 kg/sq.cm, the pumps will go on delivering hydraulic fluid into the reservoir at zero pressure; as a result of this, the service life of the pumps is considerably increased, and the temperature prevailing in the entire system, to a great extent reduced.

From the unions of the hydraulic accumulators providing for a constant pressure, fluid is fed via a pipe 8 x 6 mm in diameter to the pump unloading unit control slide valve which automatically maintains pressure within 120 $\pm$ 5 to 155 $\pm$ 5 kg/sq.cm. On passing through the above pipe, hydraulic fluid is sent into electric pressure gauge transmitter 47 which supplies current to the indicator (pressure gauge proper) mounted on the instrument panel in the pilots' cabin, the current magnitude being a function of the pressure in the system.

From valve 10 fluid is directed through four fine filters 11 and non-return valves 4 to the four hydraulic boosters and valves 15 and 31.

Non-return valves 4 cause the fluid to be trapped in the hydraulic booster chambers when loads transmitted from the main rotor come to exceed the hydraulic booster pressure rating; this prevents the hydraulic booster pistons against reversed movement.

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The hydraulic booster incorporated in the foot control system does not employ any non-return valve as the tail gear box worm pair controlling tail rotor pitch is a self-braking type, thus transmitting no effort in the reverse direction (to the hydraulic booster).

Hydraulic fluid is carried not only into the hydraulic boosters and valves 15 and 31 controlling the autopilot system, but also into pressure warning unit 20 which, with pressure coming to exceed 90 kg/sq.cm, causes voltage to be applied to a green light mounted on the instrument panel in the pilots' cabin, thus indicating that the hydraulic boosters are actuated by the fluid supplied by the main hydraulic system. On leaving valve 10, fluid is also fed to change-over units 18 incorporated in the duplicating system, and thence, to change-over slide valve 19 enclosed in the hydraulic assembly.

For checking and adjusting the helicopter control system on the ground with the main rotor at a standstill, use is made of electric pump 22 receiving power from a ground supply source or from the helicopter storage batteries. Pump 22 is started with the aid of a spring-opened switch mounted on the middle instrument panel in the pilots' cabin, near the main hydraulic system pressure gauge indicator.

When put in operation, pump 22 transfers fluid into two hydraulic accumulators 21 until pressure rises to 155 kg/sq.cm (with solenoid-controlled valve 10 closed). When the helicopter control system is being checked, valve 10 is open, and fluid from hydraulic accumulators 21 enters hydraulic boosters 12 and 14, thereby allowing the helicopter controls to be shifted throughout their entire operating ranges.

When the helicopter control system is checked on the ground (the main rotor at a standstill) such use being made of the helicopter storage battery, electric pump 22 may be started only once when it is absolutely necessary, provided the pump operating cycle does not exceed 1 min. With a ground power source connected, the pump may be allowed to run continuously for 15 min, after which it should be disengaged and allowed to cool down within a 15-min period; after that, the pump may be switched on again.

DUPLICATING HYDRAULIC SYSTEM

The duplicating hydraulic system (Fig.257) is, for the most part, identical with the main system. Just like in the case of the main system, hydraulic fluid from reservoir 2 is delivered to counterclockwise pump HM2C (Ref.No.3).

With a pressure drop in the main hydraulic system, the duplicating system is automatically cut in by change-over units 18. To provide an output amounting to that of the main system, pump HM2C incorporated in the auxiliary hydraulic system is caused to supply hydraulic fluid into the duplicating system through action of change-over slide valve 19.

On leaving pumps 3, fluid is carried via non-return valves 7 and coarse filters 8 into pump unloading unit 9 which maintains pressure in the duplicating system (when the latter is employed for operating the hydraulic boosters) within 120 ± 5 to 155 ± 5 kg/sq.cm.

From non-return valve 40 installed downstream of pump unloading unit 9, the pipeline runs in parallel with the main system line to hydraulic accumulator 21, the two change-over units 18, electric pressure gauge transmitter 47, and solenoid-

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controlled valve 10. Having passed through valve 10, fluid is carried via two fine filters 11 and non-return valve 4 into the hydraulic boosters, and via valve 15, into wing hydraulic control mechanism PMK-I. Two change-over units 18 are employed to ensure a guaranteed change-over to the duplicating hydraulic system.

From the pipeline running between valve 10 and non-return valves 4, hydraulic fluid is also fed to pressure warning unit 20 which, with pressure in the duplicating system rising over 90 kg/sq.cm, sends electric pulses to the two red light panels mounted on the instrument panel in the pilots' cabin, thus indicating that the hydraulic boosters have been connected to the duplicating system and that the main hydraulic system should be cut off by setting the tumbler switch of solenoid-operated valve 10 in the VALVE OFF (КРАЙ БЫКЛИК) position.

AUXILIARY HYDRAULIC SYSTEM

From the upper portion of duplicating system reservoir 2 hydraulic fluid flows to pump 3 (Fig.257) through disconnect valve 16, the pump being installed on the rear wall of the main gear box, too. Hydraulic fluid supply from the upper portion of the reservoir allows operation of the duplicating system in case of the auxiliary hydraulic system failure. In the event hydraulic fluid drains out of the auxiliary system, some amount of fluid still remains trapped in the lower portion of the reservoir, whence it is delivered into the duplicating system.

Pump 3 operates to deliver fluid via coarse filter 8 and change-over slide valve 19 into pump unloading unit 9 whose function is to maintain pressure in the system within 120 ± 5 to 155 ± 5 kg/sq.cm. On leaving pump unloading unit 9, fluid is carried via non-return valve 40 and fine filter 11 into hydraulic accumulator 21, pressure gauge transmitter 47, and other units operating from this system.

The hydraulic fluid return line also incorporates fine filter 11 to prevent contamination of fluid delivered into the reservoir from the auxiliary system units.

The auxiliary system incorporates a number of units rated for an operating pressure of 60 kg/sq.cm. To reduce the pressure of 120 to 155 kg/sq.cm down to this operating value, provision is made for reducing valve 37 from which hydraulic fluid is fed to the collective pitch-throttle control lever locking system and the pilots' seat hydraulic control mechanisms.

The helicopter is furnished with hand pump 23 designed for building up pressure in the auxiliary system when the helicopter is parked and the main rotor is at a standstill. Connected in parallel with hand pump 23 is electric pump 22 which is also capable of building up pressure in the auxiliary hydraulic system with the main rotor out of operation. Pump 22 draws its power from a ground supply source.

With the hydraulic boosters changed for supply over to the duplicating system while in flight, pump 22 is started for a short period of time (not more than 15 min) to build up pressure in the auxiliary system, thus allowing short-time operation of the auxiliary system units; the pump delivers hydraulic fluid through coarse filter 24 into the auxiliary system hydraulic accumulator until pressure rises to 155 kg/sq.cm. Repeated starting of pump 22 is allowed only after a 15-min cooling-down interval.

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The lines feeding the cowl servicing platform actuating cylinders incorporate metering valves 43 to prevent hydraulic fluid penetration from the auxiliary system into the engine compartments as a result of breakage of the pipeline; the metering valves operate to cut off the damaged sections of the hydraulic system.

HYDRAULIC ASSEMBLY

The hydraulic assembly comprises the following units: main system reservoir, duplicating and auxiliary system reservoir, four hydraulic accumulators, main system filter unit, duplicating and auxiliary system filter unit, two electric pumps 465M, three pump unloading units 1A-77MH, two solenoid-controlled hydraulic valves, two change-over units 1A-255, change-over slide valve, and a number of other components of the main, duplicating, and auxiliary hydraulic systems, as well as a network of pipelines interconnecting these components.

All units incorporated in the hydraulic assembly are installed on a separate framework which allows mounting the assembly on a work bench; after subjecting the hydraulic assembly to complex tests for serviceability, it can be installed right on the helicopter as an integral unit.

Connection of the hydraulic assembly to the hydraulic system is accomplished through use of quick-disconnect valves. Together with the above-indicated features, this tends to substantially simplify assembly procedures and adds to the reliability of the hydraulic system. Besides, compact arrangement of the units in a single assembly allows the use of shorter connecting pipelines.

The hydraulic assembly framework is welded from cromansil tubes. Attachment to the helicopter is effected through the use of four lugs having six holes for coupling bolts. The framework mounts four seats for accommodating the hydraulic reservoirs held in place with the aid of bands, panels for fastening the quick-disconnect valves and hydraulic units, a support for the hydraulic accumulators, and an instrument corner plate carrying the pressure gauge and pressure warning unit transmitters.

HYDRAULIC RESERVOIRS

The hydraulic assembly accommodates two reservoirs for hydraulic fluid that are similar in capacity; one of them is incorporated in the main hydraulic system (Fig. 259) and the other one holds hydraulic fluid used in the duplicating and auxiliary systems (Fig. 260).

The auxiliary system makes use of the hydraulic fluid contained in the upper portion of the reservoir. To achieve this, the suction union adapter welded into the lower portion of the reservoir is provided with an extension pipe through which hydraulic fluid is carried into the pipeline connected to the pump.

Each reservoir holds 40 to 45 li* of hydraulic fluid AMT-10 in addition to the fluid trapped in the helicopter hydraulic system.

The reservoirs are welded from aluminum alloy sheets. To add to rigidity of the reservoirs, they are fitted with two partitions 8 secured by spot welding. Made just opposite the partitions at both sides of the reservoir (on its shells) are flutes between which clamping bands are located serving for attachment of the reservoirs in the hydraulic assembly. Reservoir shells 1 and bottoms 2 are manu-

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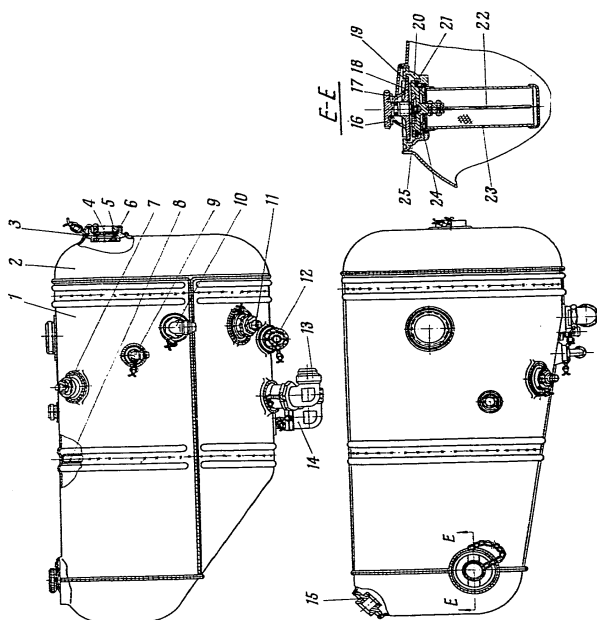


FIG. 259. MAIN HYDRAULIC SYSTEM RESERVOIR (4)

1 - shell; 2 - bottom; 3 - vent; 4 - level indicator glass; 5 - nut; 6 - sealing ring; 7 - seal; 8 - partition; 9 - elbow for connection of pipeline for fluid return from autopilot servo units; 10 - elbow for connection of pipeline for fluid return from autopilot servo units; 11 - union for connection of suction pipeline led from electric pump (65M); 12 - union for connection of suction pipeline led from ground supply unit; 13 and 14 - elbows for connection of suction pipelines led from pumps (110C); 15 - pump; 16 - spring; 17 - spring; 18 - crosspiece; 19 - for attachment of hydraulic reservoir shell; 20 - filter; 21 - gauze filter; 22 - dipstick; 23 - spring washer; 24 - spring washer; 25 - adapter for connection of pipeline for fluid return from pump shell; 26 - adapter for connection of pipeline of vent pipeline of hydraulic unloading unit (A-77NH); 28 - union for connection of vent pipeline of hydraulic units.

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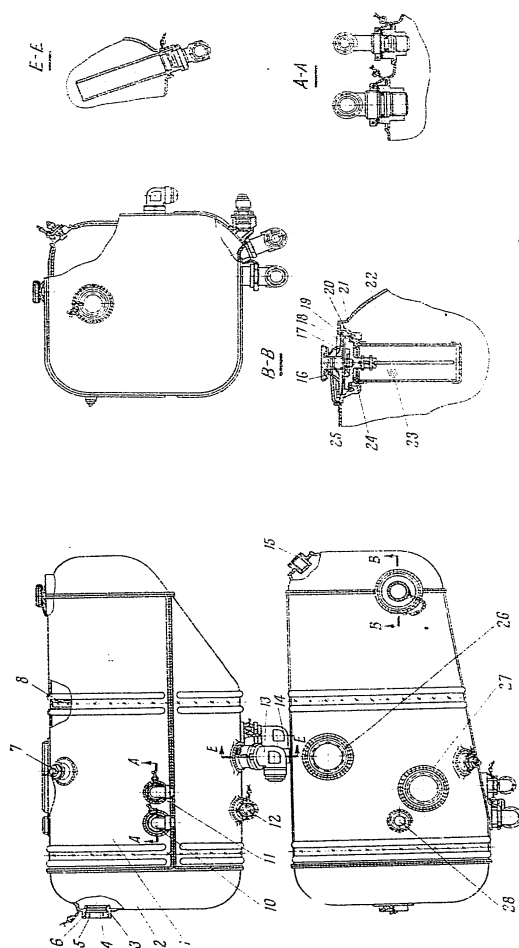


FIG. 200. DUPLICATING AND AUXILIARY SYSTEM HYDRAULIC RESERVOIR.

1 - shell; 2 - bottom; 3 - level indicator casing; 4 - level indicator; 5 - vent; 6 - sealing ring; 7 - receiver vent unit; 8 - pump; 9 - pump; 10 - elbow receiving pipeline for fluid return from hand pump III-01 and electric pump; 11 - elbow receiving suction pipeline from hand pump III-01 and electric pump; 12 - pump; 13 - elbow for connection of suction pipeline led from ground supply unit; 14 - elbow for connection of auxiliary system suction pipeline; 15 - adapter for attachment of connecting pipe; 16 - screw; 17 - handle; 18 - crosspiece; 19 - filter cover; 20 - filter shell; 21 - sealing ring; 22 - dipstick; 23 - gauge filter; 24 - spring washer; 25 - ring; 26 - adapter for receiving pipeline of fluid return from auxiliary system pump; 27 - adapter for connection of duplicating system pump; 28 - unit for connection of vent pipeline of hydraulic units.

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factured from sheet material AMI amounting to 1.2 mm in thickness; the partitions are made of the same material 0.8 mm thick.

The welding completed, the reservoirs are subjected to hydraulic tests at a pressure of 0.5 kg/sq.cm; besides, the reservoirs are tested for tightness by air compressed to 0.1 kg/sq.cm.

Provided on the face wall of each hydraulic reservoir is an oil level indicator. Made on level indicator glass 4 are notches indicating maximum and minimum permissible levels of hydraulic fluid in the reservoirs.

The upper portion of each reservoir incorporates a filler fitted with cover 19 which is sealed by rubber ring 21. When the filler is closed, crosspiece 18 is fitted into the grooves of filler shell 20 and is turned as far as it will go. Screw 16 forces the crosspiece against the upper lug of the shell, as a result of which cover 19 closes the filler, ring 21 providing for hermetic sealing. Screw 16 is locked by spring 17 whose projections engage the slots machined on the screw lower surface.

Riveted to cover 19 is dipstick 22^④ with notches indicating the maximum and minimum permissible levels of hydraulic fluid. Accommodated in the filler shell is brass gauze filter 23 which is forced against the flange of the filler shell by the cover depressing spring 24.

Welded on top of the hydraulic reservoirs are adapters receiving the fluid return pipelines led from pump unloading units 1A-77MH; the adapters accommodate gauze filters (foam dampers), each comprising a steel framework made of a perforated tube that is enclosed in a brass gauze. The foam dampers are designed for reducing velocity of the hydraulic fluid supplied into the reservoir from the pump unloading units.

The hydraulic reservoirs communicate via connecting pipe 59 (Fig. 257) laid at the upper level of hydraulic fluid in the reservoirs. Such an arrangement of the pipe provides for maintaining hydraulic fluid in both reservoirs at the same level irrespective of possible fluid flow from one system into the other via the duplicating system change-over mechanisms and other units.

By means of vent unions 7 (Figs 259 and 260) the hydraulic reservoirs and the pipelines connected to them communicate with the free air.

Welded into the hydraulic reservoir shells and bottoms are adapters receiving elbows and unions for connection of the pipelines for fluid suction from the reservoir and for fluid return into the reservoir from the hydraulic units, as well as for connection of the vent pipelines. Captions to Figs 259 and 260 explain the purpose of the elbows and unions.

PUMP UNLOADING UNIT 1A-77MH

The pump unloading unit is designed for maintaining pressure in the hydraulic system within the specified limits. As soon as a predetermined maximum pressure is built up in the hydraulic system, the unit operates to switch pump HM2C over to idle running, thereby unloading the latter; when pressure in the system drops below a predetermined value, the unit will switch on the pump for operation once again to save the situation.

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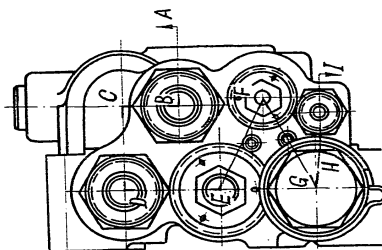
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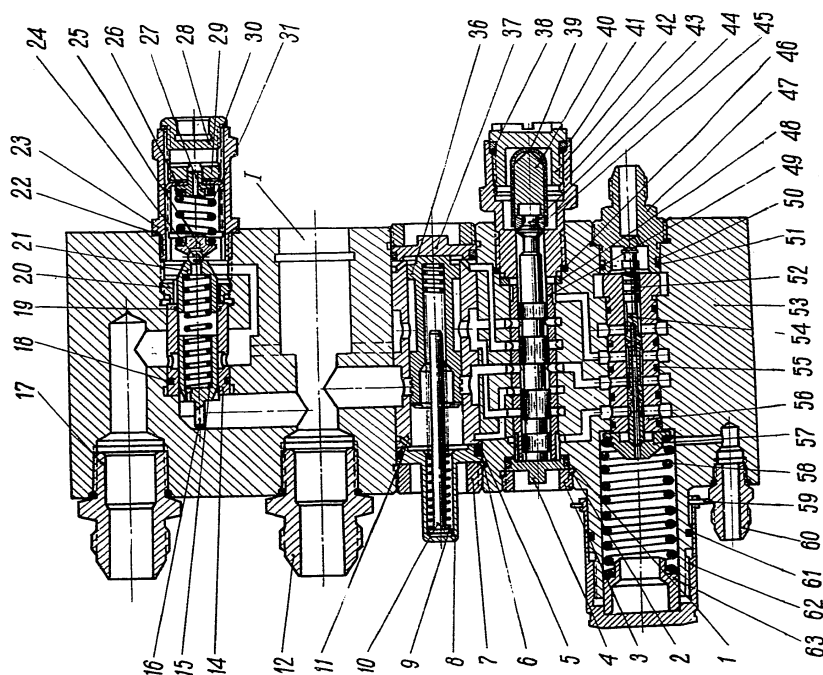
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FIG. 261. PUMP UNLOADING UNIT

I - cavity for connection of non-re-turn valve
 1 - 2, 5, 6, 18, 19, 38, 41, 46, 48, 50, 51, 55, and 61 - sealing rings;
 3, 28, 42, and 43 - plugs; 4 - washer;
 7 - nut; 8 - cup; 9, 13, 31, and 38 - springs; 10 - stem; 11, 14, 49, and 56 - liners; 12, 15, and 20 - gaskets;
 16, 44, and 54 - side valves;
 17 - seal; 22, 26, and 30 - threaded bush;
 21 - screw; 24 - ball; 25 and 63 - supports; 27 - guide; 29 - adjusting screw; 36 - piston; 37 - plug; 39 - plate spring; 40 - stop; 45 - half-finger; 52 - plunger; 53 - housing; 57 - supporting washer; 59 - spring lock; 62 - bonnet.



A-B-C-D-E-F-G-H-I



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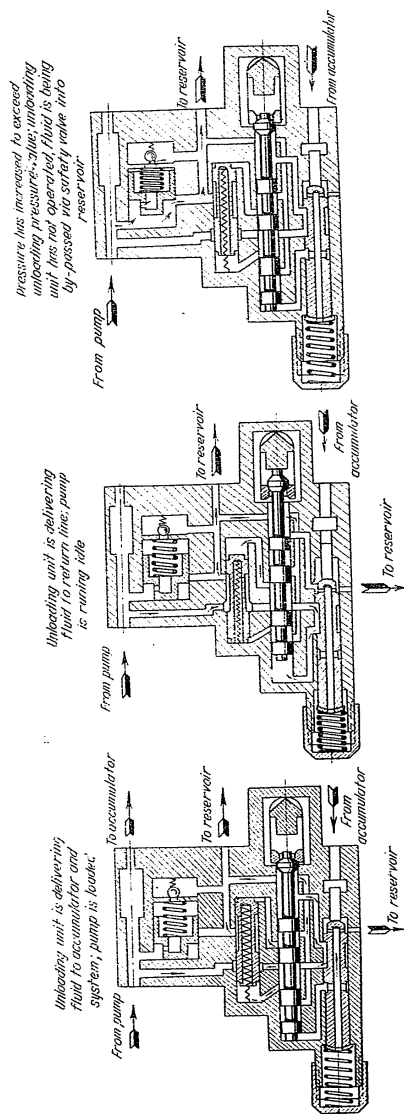


FIG. 262. SCHEMATIC DIAGRAM OF PUMP UNLOADING UNIT 1A-77M11.

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Basic Specifications

Pump disengagement pressure 155 ± 5 kg/sq.cm
 Pump engagement pressure 120 ± 5 kg/sq.cm
 Pressure at which hydraulic fluid
 is by-passed to return line via
 safety valve 170 ± 10 kg/sq.cm
 Working fluid AMT-IO
 Rate of fluid flow through unloading
 unit up to 80 lit/min

P r i n c i p l e o f o p e r a t i o n (Figs 261 and 262). With no pressure either in the hydraulic system or in the hydraulic accumulator, hydraulic fluid from pump HMEC is supplied into the system. When hydraulic fluid pressure in the system is increased to 155 ± 5 kg/sq.cm, plunger 52 will displace slide valve 54 to the left against the force of spring 58; as a result, hydraulic fluid will flow via a groove under the left face of intermediate slide valve 44 thereby shifting it to the right; part of the fluid trapped on the right side of slide valve 44 is forced into the reservoir.

One groove of slide valve 44 affords communication between the chamber to the left of piston 36 and the return line (via a union), whereas the other groove connects the chamber to the right of piston 36 with inlet union 12; this makes for increasing pressure in the right-hand chamber. As a result, piston 36 moves to the left to connect union 12 with union 17, thereby by-passing the entire amount of hydraulic fluid from the pump into the reservoir.

If pressure in the hydraulic accumulator drops down to 120 ± 5 kg/sq.cm, spring 58 will force slide valve 54 along with plunger 52 to the right, as a result of which hydraulic fluid from union 12 will flow via the groove of slide valve 54 under the right face of intermediate slide valve 44, thus forcing the slide valve to the left.

One groove machined in slide valve 44 connects the chamber to the right of piston 36 to the return line (via a union), whereas the other groove in the slide valve affords communication between the chamber to the left of piston 36 and delivery union 12, due to which piston 36 moves to the right and cuts union 12 off the return line. The pump starts feeding hydraulic fluid into the system.

Fig. 261 illustrates operation of the pump unloading unit safety valve. If, for some reason or other, the unloading unit fails to operate when pressure increases to 155 ± 5 kg/sq.cm, thereby failing to unload the pump, pressure will rise to 170 ± 10 kg/sq.cm. The pressure increase will cause ball 24 to overcome the force of spring 31 and to come off the seat; as a result, hydraulic fluid starts flowing into the return line.

As long as the ball is pressed against the seat, pressure on both sides of slide valve 16 will be equalized; in this case, the slide valve is kept by spring 15 in the extreme left-hand position, the hole in the seat thus being closed. As soon as the ball is unseated, the chamber to the right of the slide valve gets connected to the return line. As a result, hydraulic fluid pressure to the left of the slide valve comes to exceed that to the right of the slide valve, due to which the slide valve will start moving to the right against the force of spring 15; the hole in liner 14 will be opened, and hydraulic fluid will start to flow to the return line. This will prevent further increase of pressure in the system.

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In case hydraulic fluid pressure in the system drops somewhat below 155 kg/sq.cm (for example, due to abrupt actuation of the controls), the ball will be forced by spring 31 against the seats, which will stop the flow of hydraulic fluid through small aperture of slide valve 16; this, in turn, will result in pressure on both sides of slide valve 16 getting equalized. Slide valve 16 will be shifted by spring 15 to the extreme left-hand position, and will blank off the hole in liner 14, thereby cutting hydraulic fluid off the return line.

To guard slide valve 44 against displacement due to vibration and jerks, provision is made for a lock consisting of two half-rings 45 which bring the ends of plate spring 39 apart to come up against stop 40. With the slide valve starting to move to the right, it presses half-rings 45, thereby shifting them away from each other. The half-rings, in turn, bring apart the ends of plate spring 39, and the slide valve is allowed to move to the extreme right-hand position. When the slide valve is to move in the reverse direction (to the extreme left-hand position), the lock will operate in a similar way.

SOLENOID-CONTROLLED HYDRAULIC VALVE 7A-74M/7

The valve is intended for connection and disconnection of the hydraulic boosters from the main and duplicating systems.

Basic Specifications

Working fluid	AMT-10
Minimum operating pressure required	
for valve change-over	5 kg/sq.cm
Voltage applied to solenoid	22 to 27 V
Current drained by solenoid	
at 24 V	Not over 10 A

P r i n c i p l e o f o p e r a t i o n . When right-hand coil 15 is energized, armature 20 is attracted to limiter 19, i.e. assumes the extreme right-hand position (Figs 263 and 264). This will cause slide valve 10 to connect chamber to the right of slide valve 5 with the return line. Hydraulic fluid pressure in the boring under plunger 3 will shift slide valve 5 to the extreme right-hand position, thereby disconnecting unions 24 and 25 from each other. With the slide valve in this position, the hydraulic unit is disconnected from the pump; this done, union 25 communicating with the unit controlled is connected to the return line via a flat on slide valve 5.

When the left-hand coil is energized, armature 20 is attracted to limiter 12, i.e. assumes the extreme left-hand position. In this case, slide valve 10 connects the chamber under the right-hand face of slide valve 5 with the high-pressure chamber. Slide valve 5 moves to the left, thus establishing communication between unions 24 and 25. With the slide valve in this position, the unit is connected to the pump.

When slide valve 5 moves to the left, plunger 3 forces hydraulic fluid out of the slide valve chamber via the small aperture; this results in a somewhat delayed movement of the slide valve when the solenoid-controlled valve is engaged.

To provide for proper tightening of union 2, use is made of spring washer 23.

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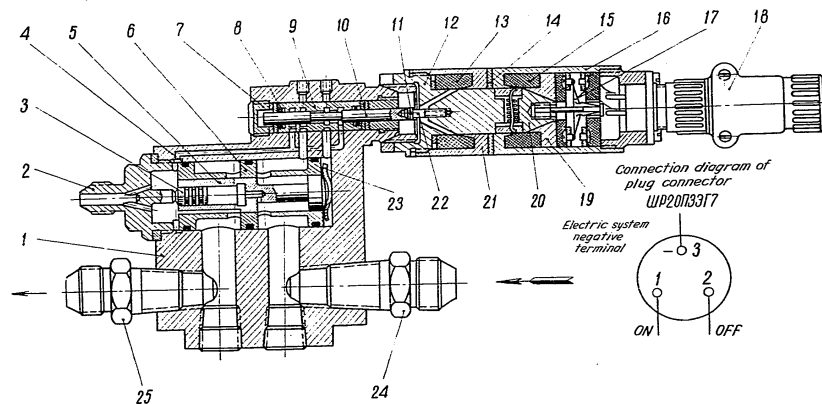


FIG. 263. SOLENOID-CONTROLLED HYDRAULIC VALVE ΓA-74M/7
 1 - housing; 2 - union; 3 - plunger; 4 - rubber ring; 5 and 10 - slide valves; 6 and 9 - liners; 7 - stop; 8 - rubber cup; 11 - lock; 12 - front limiter (front stop); 13 - left-hand coil; 14 - copper gasket; 15 - right-hand-coil; 16 - solenoid right-hand-section; 17 - microswitch; 18 - plug connector; 19 - rear limiter (rear stop); 20 - armature; 21 - solenoid left-hand section; 22 - link; 23 - washer; 24 and 25 - unions.

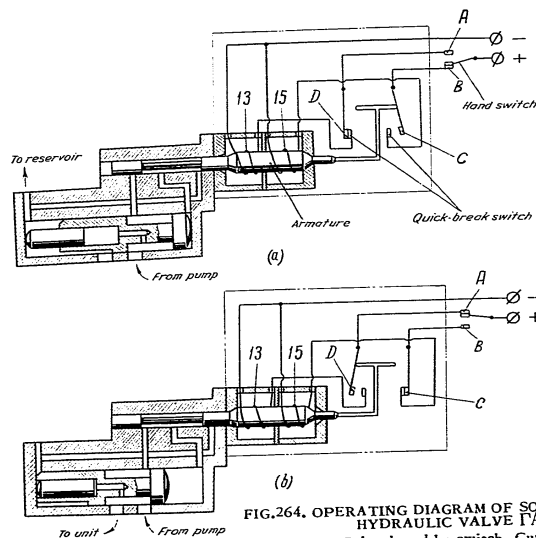


FIG. 264. OPERATING DIAGRAM OF SOLENOID-CONTROLLED HYDRAULIC VALVE ΓA-74M/7

(a) - contact B is closed by switch. Current is sent into coil 15, causing armature to move to the right; at the end of stroke armature works against switch C, thereby breaking circuit. Unit controlled is disengaged;
 (b) - contact A is closed by switch. Current circulates through coil 13, as a result of which armature moves to the left, presses switch D at the end of stroke, and breaks circuit. Unit controlled is engaged;
 13 - left-hand-coil; 15 - right-hand-coil (See Fig. 263).

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CHANGE-OVER UNIT 1A-255

Change-over unit 1A-255 operates to switch the duplicating system from idle running over to fluid supply into the hydraulic boosters when pressure in the main hydraulic system decreases, and to supply a hydraulic pulse to the change-over slide valve, which causes auxiliary system pump HM2C to feed hydraulic fluid into the duplicating system.

Basic Specifications

Pressure in main hydraulic system
at which duplicating system is
switched on 75 ± 5 kg/sq.cm

Pressure in main hydraulic system
at which duplicating system is
switched off 100^{+10}_{-7} kg/sq.cm

Maximum operating pressure 160 kg/sq.cm

Working fluid AMT-IO

P r i n c i p l e o f o p e r a t i o n. When pressure in the main hydraulic system rises to 100 kg/sq.cm, valve 19 and seat 16 with pistons 7 and 12 will be forced by fluid pressure to the left (Figs 265 and 266). On coming up against the seat in stem 6, valve 13 cuts the return chamber off the chamber of piston 12. Seat 16 with pistons 7 and 12 will be made by hydraulic fluid to compress spring 5 and move further to the left, thus disengaging from valve 19. As a result, valve 19 opens, allowing hydraulic fluid to flow to the chamber of piston 32 via restricting holes in valve 19 and in screw 15, as well as via the clearance between valve 13 and the chamber of screw 15; as a result, pressure will be increased, and the piston will be moved to the left.

Now, the piston comes up against the rod of valve 33, thereby compressing spring 34 and unseating the textolite valve; this makes it possible for hydraulic fluid to flow from the duplicating system pump right into the reservoir, i.e. the duplicating system pump is changed over to idle running.

When pressure in the main hydraulic system drops below the minimum permissible value, seat 16 with pistons 7 and 12 will return to the initial position. In this case, seat 16 will first reach the cut-off wedge of valve 19 thus cutting the chamber of piston 12 off chamber 11 connected to the main system pump union; moving further to the right, seat 16 will actuate valve 19 with screw 15 and valve 13. The latter will come off the seat in stem 6 to connect the return chamber with the chamber of piston 12. Thus, the chamber of piston 32 will get connected to the return line via an oblique passage in housing 1, the restricting holes in liner 8, and the holes in piston 12; under the force of spring 5, the piston will move to the initial position, thereby closing unloading valve 33 and applying load to the duplicating system pump.

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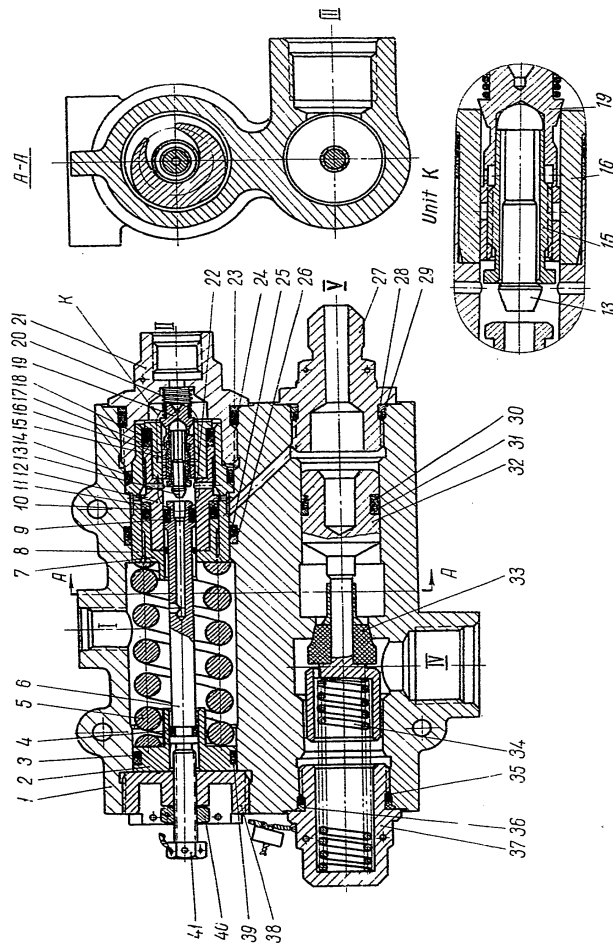


FIG. 265. CHANGE-OVER UNIT 1'A-255
 I - chamber connected by pipeline to main hydraulic system reservoir; II - chamber connected by pipeline to main hydraulic system; III - chamber connected by pipeline to duplicating hydraulic system reservoir; IV - chamber connected by pipeline to change-over slide valve; V - duplicating hydraulic system pump; 1 - support; 2 - support; 3, 4, 9, 10, 14, 18, 24, 25, 29, 30, and 35 - rubber rings; 5, 20, and 34 - springs; 6 - stem; 7, 12, and 13 - housings; 8 - liner; 11, 17, 22, 23, 26, 28, 31, 36, and 39 - leather rings; 13 and 19 - valves; 15 - screw; 16 - seat; 21 and 32 - pistons; 38 - plugs; 27 - SIGNALLING PRESSURE (СИГНАЛЬНОЕ ДАВЛЕНИЕ) union; 33 - textile valve with rod; 37 - sleeve; 40 - nut; 41 - adjusting screw.

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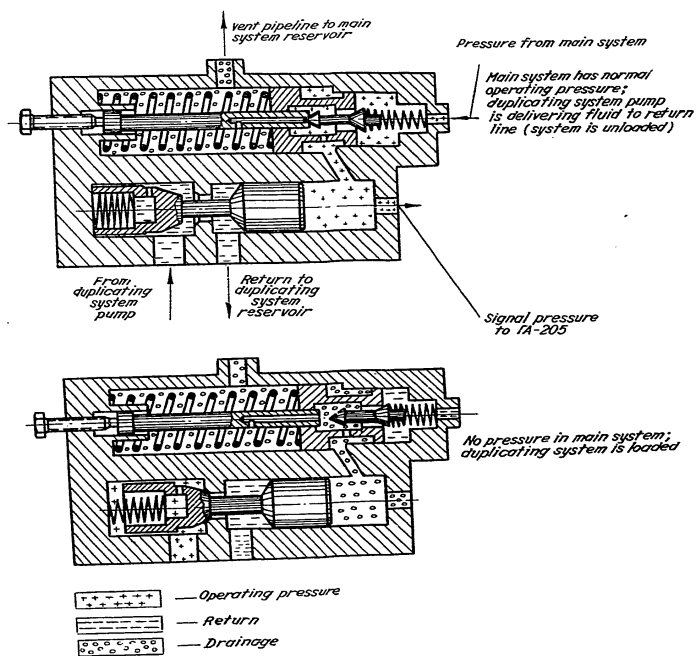


FIG.266. SCHEMATIC DIAGRAM OF CHANGE-OVER UNIT IA-255.

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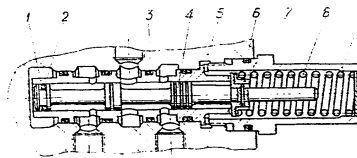


FIG.267. CHANGE-OVER SLIDE VALVE
 1 - liner; 2, 3, and 6 - sealing rings; 4 - slide valve; 5 - housing;
 7 - sleeve; 8 - spring; 9 - bonnet.

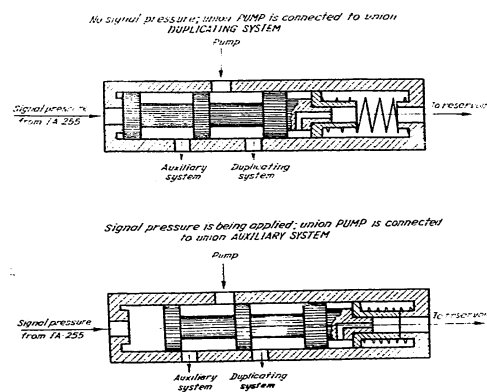


FIG.268. SCHEMATIC DIAGRAM OF CHANGE-OVER SLIDE VALVE.

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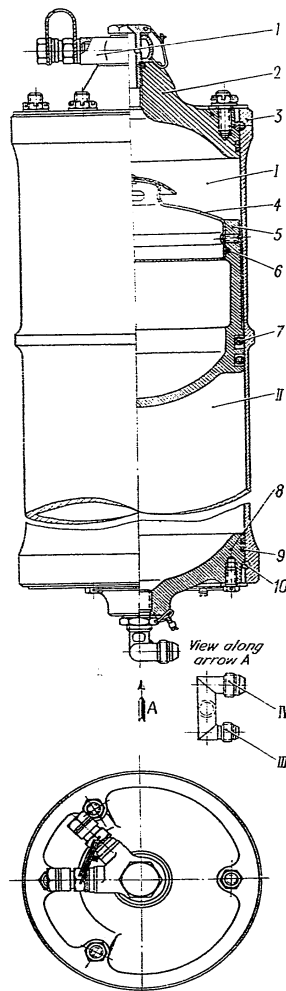


FIG. 269. HYDRAULIC ACCUMULATOR
 I - gas chamber
 II - hydraulic chamber
 III - union for connection of pipeline to ΓA-77MH
 pump unloading unit control slide valve
 IV - union for connection of pipeline to ΓA-77MH
 unloading unit fluid outlet pipe
 1 - unions; 2 and 8 - covers; 3 - cylinder;
 4 - piston cap; 5 - piston; 6, 7, and 9 - rubber
 rings; 10 - steel ring .

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CHANGE-OVER SLIDE VALVE

Basic Specifications

Working fluid AMT-IO
 Operating pressure 120 to 155 kg/sq.cm
 Pressure in main hydraulic system at
 which auxiliary system pump starts
 feeding fluid into duplicating system not over 45 kg/sq.cm
 Principle of operation (Figs 267 and 268). The stream
 of hydraulic fluid flowing from the auxiliary system pump is directed by means of
 slide valve 4 which can be operated to two positions.

When fluid from the main hydraulic system enters the SIGNALLING PRESSURE
 (СИГНАЛЬНОЕ ДАВЛЕНИЕ) chamber, slide valve 4 along with sleeve 7 and spring 8
 will be forced to the right; sleeve 7 will come up against the face of groove in
 bonnet 9, as a result of which the slide valve will assume a position involving
 connection of the PUMP (НАСОС) chamber with the AUXILIARY SYSTEM (ВОСПОМОГАТЕЛЬНАЯ
 СИСТЕМА) chamber.

As soon as pressure in the main hydraulic system drops below 45 kg/sq.cm, thus
 causing a respective pressure drop in the SIGNALLING PRESSURE chamber, slide val-
 ve 4 with sleeve 7 will be caused by spring 8 to move to the extreme left-hand po-
 sition; as a result, the PUMP chamber will be connected to the DUPLICATING SYSTEM
 (ДУБЛИРУЮЩАЯ СИСТЕМА) chamber.

HYDRAULIC ACCUMULATORS

The hydraulic accumulators are designed for accumulating hydraulic energy and
 feeding hydraulic fluid into the respective units when the pumps are engaged for
 delivering fluid into the reservoir. Each 12-litre capacity hydraulic accumulator
 consists of steel cylinder 3 (Fig.269), two covers 2 and 6 held in place by steel
 rings 8, piston 4, and other components. The covers and the piston are sealed by
 rubber rings 5 and 7.

Installed in the upper part of the hydraulic accumulator are unions 1 enclos-
 ing valves. One of the unions is used for charging the hydraulic accumulator with
 nitrogen compressed to $85 \cdot 10^5$ kg/sq.cm in the case of main and duplicating system
 hydraulic accumulators, and to 30 ± 2 kg/sq.cm, in that of the auxiliary system
 accumulators. The other union is employed for connection of an appliance checking
 the pressure to which the hydraulic accumulators are charged with nitrogen. The
 charging completed, the valves are forced by the springs against their seats, thus
 preventing nitrogen leakage.

Screwed into the lower cover of the hydraulic accumulator is a T-piece receiv-
 ing two pipelines; one pipeline, 12 x 10 mm in section, runs from pump unloading
 unit 1A-77MH, and the other, 8 x 6 mm in section, from the control slide valve
 of the same unit.

Hydraulic chamber II of the accumulator is separated by piston 4 from gas
 chamber I. With the hydraulic chamber being filled with working fluid, the gas
 chamber volume decreases, involving an increase in nitrogen pressure, which results
 in the accumulator being charged.

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To prevent nitrogen leakage when there is no pressure in the hydraulic chamber, and to lubricate the walls of cylinder 1, the piston is provided with cover 9 on top of which there is 80 gsm of working fluid AMP-IO. Riveted to the cover top is a guard lip.

With the pumps running, the hydraulic accumulators are charged to a pressure of 155 kg/sq.cm, after which the pumps are switched over for returning fluid into the reservoir. The hydraulic accumulator supplies fluid into the hydraulic boosters at the expense of nitrogen expansion from 155 to 120 kg/sq.cm. The hydraulic accumulator is also designed to attenuate variations in hydraulic fluid pressure and provides for proper operation of pump unloading unit IA-77MH.

The auxiliary system hydraulic accumulator keeps the units running until pressure in it drops down to 30 kg/sq.cm; this allows a more extensive use of the accumulated energy for actuation of the auxiliary system units when servicing the helicopter on the ground.

FILTER ASSEMBLY

The filter assembly incorporated in the main hydraulic system is designed for accommodation of coarse and fine filtering elements, non-return valves, as well as for attachment of the solenoid-controlled valve and for affording communication between the above units.

The filter assembly housing (Fig.270) is manufactured from aluminum alloy. Fitted into the housing top are coarse and fine filter covers 8⁶ accommodating respective filtering elements 1. The covers are screwed into the housing and locked by means of rod 9⁶ which is also used as a tommy bar for filter installation and dismantling. The covers are sealed by rubber rings 6 and fluoroplastic gaskets 7.

Screwed into the filter assembly housing from below are filter sleeves 2 sealed in the same manner. The lower parts of sleeves 2 accommodate threaded plugs 23. Springs 20⁶ prevent working loose of the filtering elements out of the covers. Screwed into the filter assembly housing are inlet unions 14 and 15⁶ enclosing non-return valves 11 and 17 that are forced against their seats by springs 10 and 18.

The coarse filter employs a safety valve which opens when the filtering elements get clogged due to rise of the pressure differential above the specified value.

Held to the filter assembly housing by nuts screwed on two studs is a solenoid-controlled hydraulic valve which is connected to the filter assembly by pipelines.

Inscriptions on the filter assembly housing explain the purpose of the unions and filters and indicate the position of the filter cover locks, letters O and 3 standing for OPEN (ОТКРЫТО) and CLOSED (ЗАКРЫТО), respectively.

The filter assembly used in the duplicating and auxiliary systems is similar in construction to that employed by the main hydraulic system, the differences being as follows: the assembly mounts the auxiliary system change-over slide valve and a coarse filtering element of the 6L-71⁶ type. The assembly housing accommodates a liner receiving the change-over slide valve with a small clearance being provided. Slide valve travel is limited by the cover and the bush. The spring acting on the stop forces the slide valve to the liner face which has grooves for the passage of hydraulic fluid. The slide valve, the liner, and the cover are sealed by rubber rings.

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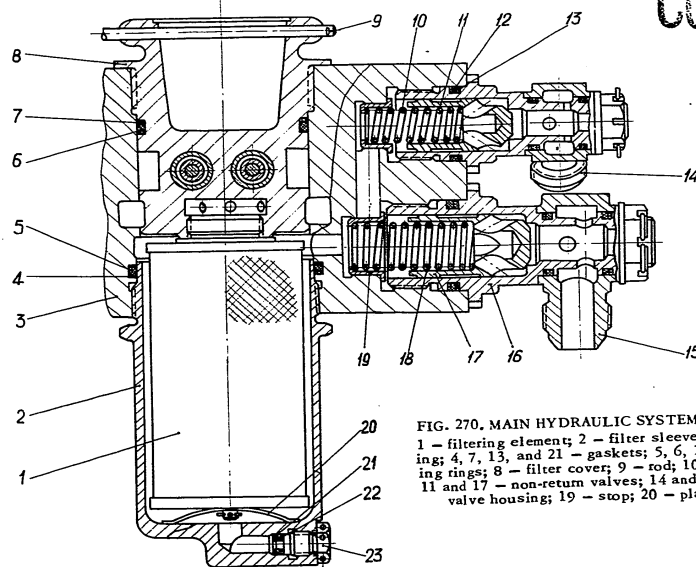


FIG. 270. MAIN HYDRAULIC SYSTEM FILTER ASSEMBLY⁵
 1 - filtering element; 2 - filter sleeve; 3 - filter assembly housing; 4, 7, 13, and 21 - gaskets; 5, 6, 12, and 22 - rubber sealing rings; 8 - filter cover; 9 - rod; 10 and 18 - valve springs; 11 and 17 - non-return valves; 14 and 15 - inlet unions; 16 - valve housing; 19 - stop; 20 - plate spring; 23 - plug.

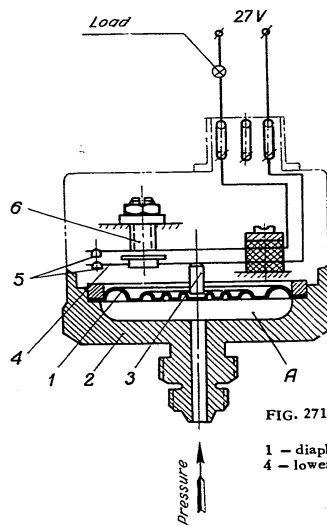


FIG. 271. PRESSURE WARNING UNIT
 CJ-90A
 1 - diaphragm; 2 - housing; 3 - centre;
 4 - lower contact spring; 5 - contacts;
 6 - adjusting screw.

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The coarse filtering element is made of metal gauze woven as twill cloth and fastened to a metal cylindrical frame. The fine filtering element is of similar construction, the only difference being that a fine mesh gauze is employed.

PRESSURE WARNING UNIT CD-90A

Pressure warning units are installed in the main and duplicating hydraulic systems and are intended for making the electric circuit as soon as pressure in the hydraulic systems rises above 90 kg/sq.cm; this being the case, the pressure warning unit sends a pulse to a light with a green cap when the main hydraulic system is in operation, or to the lamp enclosed in the red light panel when the duplicating system is on. Should pressure in the system drop below 90 kg/sq.cm, the unit contacts are automatically broken, which causes the lamp in the light panel to go out.

Principle of operation. Pressure warning unit operation depends on the interaction between varying pressure and elastic deformation of the sensitive element. The unit construction is illustrated in Fig.271.

With pressure supplied via the union into chamber A increasing, centre 3 of diaphragm 1 moves upward, thereby displacing lower contact spring 4 which operates to make contacts 5. The moment of contact make is adjusted by screw 6.

QUICK-DISCONNECT VALVE

The valve is designed for quick manual disconnection of the pipeline joints and for preventing hydraulic fluid drain from the disconnected pipelines.

Principle of operation. With holder 7 (Fig.272) turned in the counterclockwise direction (looking from union 1), pin 5 slides along the oblique groove of nut 8 and forces the rims of locking washer 13 out of recesses provided in housing 15. Further rotation causes housing 15 to be screwed out of nut 8.

With housing 15 being screwed out, springs 3 and 10 actuate valves 2 and 14, respectively, until the latter come up against the seat of bush 4 and housing 15, thereby locking the fluid in disconnected unions 1 and 9.

When the valve is to be connected, holder 7 is rotated in the reverse direction; this causes nut 8 to come out of holder 7; this done, housing 15 engages sealing 6, thus preventing hydraulic fluid from flowing out. When screwed in further, bush 4 enters union 1 and compresses springs 3 and 10, due to which the hole of valve 2 gets open, thus increasing the passage area for hydraulic fluid flow between valve 14 and housing 15.

As housing 15 and nut 8 are screwed home, the rims of locking washer 13 are caused by spring 12 to fit into the recesses of housing 15; this locks the valve against inadvertent disconnection.

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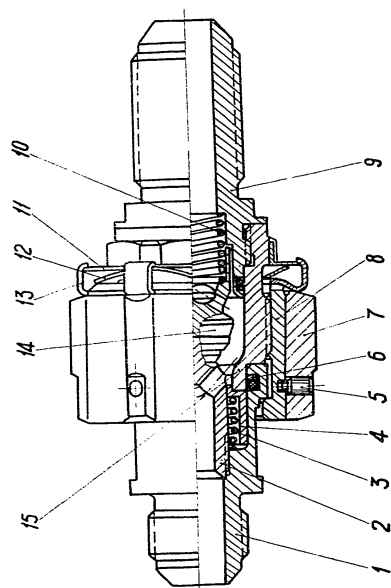


FIG. 272. QUICK-DISCONNECT VALVE
1 - union; 2 - valve; 3 and 10 - springs; 4 - bush; 5 - pin; 6 - sealing ring;
7 - holder; 8 - nut; 9 - union; 11 - holder; 12 - plate spring; 13 - locking
washer; 14 - valve; 15 - housing.

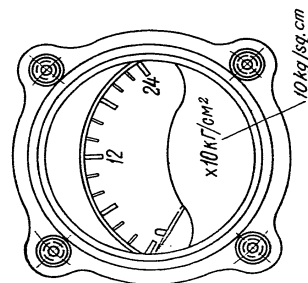


FIG. 274. ELECTRIC PRESSURE
GAUGE INDICATOR /MM-240.

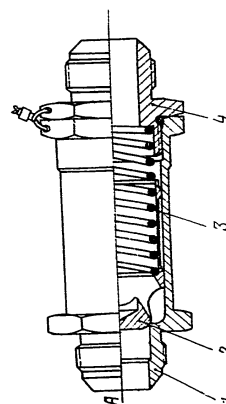


FIG. 273. NON-RETURN VALVE, TYPE OK
1 - housing; 2 - valve; 3 - spring; 4 - union.

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NON-RETURN VALVES, TYPE OK

The non-return valve allows hydraulic fluid flow in one direction only, closing the pipeline when fluid starts moving in the reverse direction.

The non-return valve (Fig. 273) consists of housing 1 and union 4. Pressed to the hole in the housing by spring 3 is valve 2.

Hydraulic fluid supplied from union A unseats the valve and flows through the unit. Fluid flow in the reverse direction is prevented by valve 2 forced against the seat in housing 1 by spring 3 and the fluid pressure.

The hydraulic system employs non-return valves with passage area diameters of 4, 6, 10, and 16 mm. The valve designation includes the passage area inner diameter of the coupling unions; for example, non-return valve of the OK-4 type has a passage area diameter amounting to 4 mm.

ELECTRIC PRESSURE GAUGE ДИМ-240

The electric pressure gauge is designed for remote measuring of pressure in the hydraulic system within a range of 0 to 240 kg/sq.cm.

The ДИМ-240 electric pressure gauge set includes a transmitter and an indicator (Fig. 274). The transmitter is connected through a union to the hydraulic system and, depending on the pressure in the system, feeds respective current to the indicator mounted on the instrument panel in the pilots' cabin. The pressure gauge transmitters are installed on the instrument corner plate accommodated in the hydraulic assembly.

ELECTRIC PUMP 465M

Plunger type electric pump 465M (Fig. 275) is intended for hydraulic fluid delivery into the main and auxiliary hydraulic systems of the helicopter on the ground (when the engines are off).

Basic Specifications

Drive	off electric motor Д-1500
Working fluid	AMP-10
Direction of rotation	counterclockwise
Maximum delivery pressure	150 ⁺⁵ kg/sq.cm
Pump output	2.5 to 3.5 lit/min
Rated voltage	26 V

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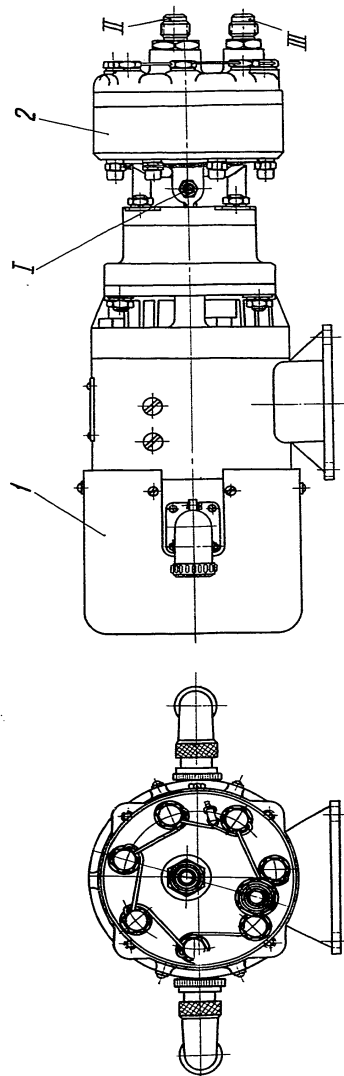


FIG. 275. ELECTRIC PUMP 46SM
I - union for connection of suction pipeline; II - union for connection of delivery pipeline;
III - union for connection of vent pipeline;
1 - electric motor; 2 - pump.

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HYDRAULIC SYSTEM UNITS**PUMP HUI2C****Basic Specifications**

Maximum pressure	180 kg/sq.cm
Working pressure	120 to 155 kg/sq.cm
Rated speed	2500 r.p.m.
Direction of rotation	counterclockwise (if viewed from attachment flange end)

Pump output at $n = 2500$ r.p.m.,
delivery pressure $P_{del} = 155$ kg/sq.cm,

absolute pressure at pump inlet equal
to 700 mm of mercury, and temperature
of 25°C at least 36 lit/min

Working fluid AMT-IO

Quantity of pumps on helicopter 4

Pump HUI2C (Fig.276) is a two-stage high-pressure gear type, driven off the
main gear box. The schematic diagram of pump operation is shown in Fig.277.

HUI2C PUMP DRAIN COLLECTOR ⑥

To prevent hydraulic fluid AMT-IO from getting onto the structural elements
of the helicopter, the pipelines running from the drain unions of the above pumps
are led to special collector 2 (Fig.278) arranged near frame No.18 of the fuselage
central part. The collector is of welded construction; its lower part carries drain
cock 1. Hydraulic fluid accumulating in the collector is drained into a container
through cock 1.

HYDRAULIC BOOSTERS

The helicopter employs four hydraulic boosters intended for reducing efforts
applied to the control sticks and foot pedals. Three hydraulic boosters EY-33A
are incorporated in the longitudinal, lateral, and directional control systems,
hydraulic booster EY-32A being used in the main rotor collective pitch control sys-
tem (see Fig.257).

Hydraulic booster EY-33A**Basic Specifications**

Distributing slide valve travel relative to point of connection with control link	2.5 to 0.5 mm
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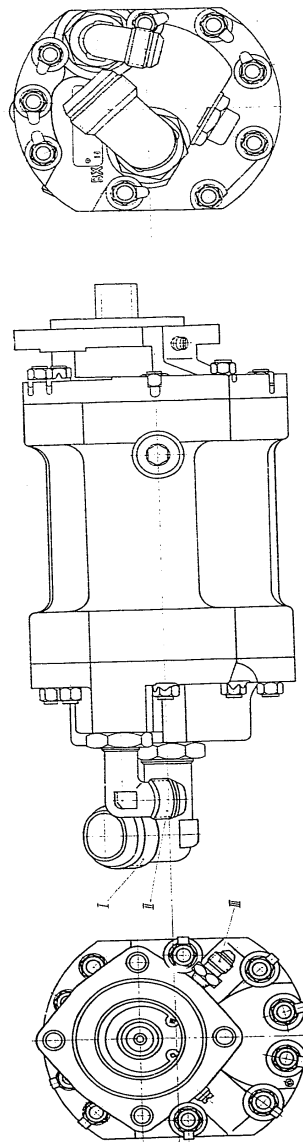


FIG. 276. PUMP H112C
I - union for connection of suction pipeline; II - union for connection of delivery pipeline; III - union for connection of vent pipeline.

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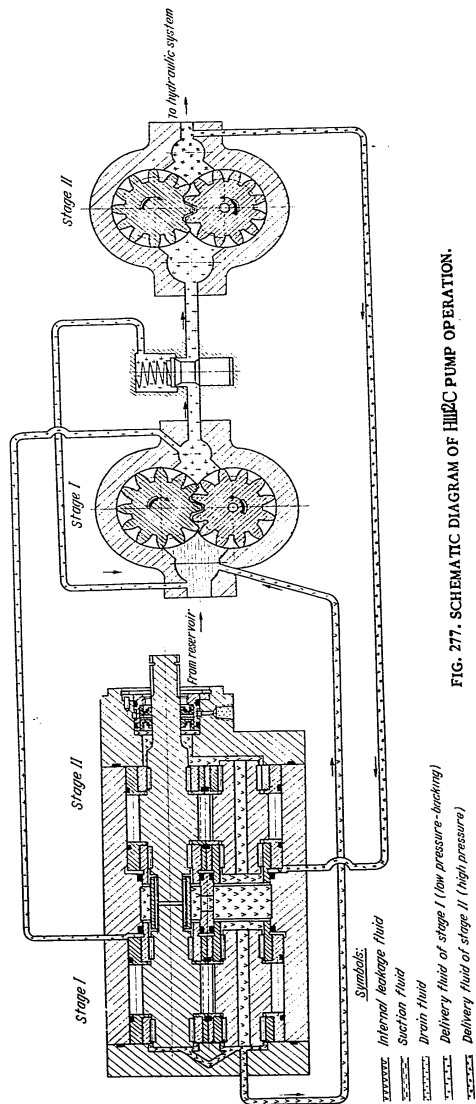


FIG. 277. SCHEMATIC DIAGRAM OF HHC PUMP OPERATION.

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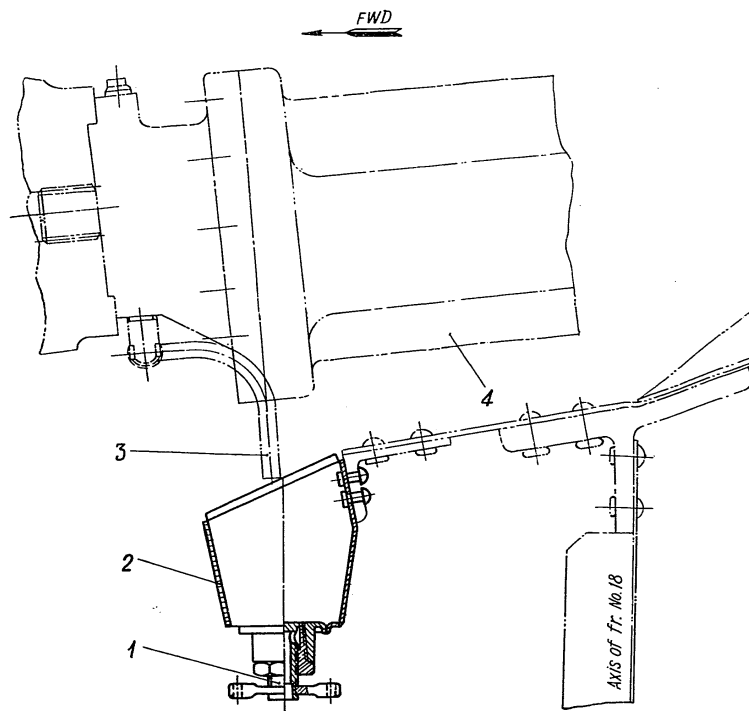


FIG. 278. COLLECTOR HOLDING HYDRAULIC FLUID DRAINING FROM PUMPS H112C ⑥
1 - drain cock; 2 - collector; 3 - drain pipe; 4 - pump H112C.

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Servo rod travel 87.5 ± 1 mm

Maximum force developed on output

bell crank at $p = 130$ kg/sq.cm

and hydraulic booster rod travelling

rate equal to zero at least 3600 kg

Working fluid AMT-10

Operating pressure of fluid 120 to 155 kg/sq.cm

Hydraulic booster EY-33A (Fig. 279) consists of a distributing and a servo devices. The distributing device is accommodated in duralumin housing 1 which serves as a basis for all the components of the hydraulic booster. Secured to housing 1 by studs 20 are two slide bearings (eyes) receiving trunnions of cylinder 3.

The slide valve distributing devices consist of liners 15 and slide valves 16; their purpose is to distribute hydraulic fluid between the working chambers of actuating cylinder 3. Liners 15 are locked in housing 1 by plugs 17. The slide valve is connected to shackle 29 through a hydraulic coupling comprising distance sleeves 22 and body 21. Attached to shackle 29 is fork 30. The fork is connected to a web mounted on the square of axle 23 enclosed in box 25 and riding in ball bearings 24. The outer square end of the axle carries a lever with link 27.

Eccentric bolt 33 attaches link 26 to link 27; link 26 is coupled to the lever of box 25 incorporated in the duplicating distributing device. Link 26 is connected to tip 34 through turnbuckle 38; the tip is mounted on bush 35 press-fitted into control bell crank 37. Bell crank travel is limited by bush 36 that is fitted on bolt 28 secured in housing 1.

To adjust the position of collars of slide valve 16 relative to the ports provided in liner 15, use is made of turnbuckle 38, the duplicating system slide valve being adjusted by means of eccentric bolt 33.

To safeguard the slide valves against auto-oscillations, provision is made for hydraulic dampers 42 and springs 18 installed under the faces of slide valves 16.

The cross-feed valve consists of slide valve 14 with collars, liner 13, spring 12, and plug 11 which acts as a limiter for slide valve 14. Liner 13 has two grooves connected by passages with the cavities of the actuating cylinder working chamber. With pressure built up at the hydraulic booster inlet, i.e. under the face of the cross-feed valve slide, the cross-feed valve collar separates the grooves in the liner, whereas with pressure at the booster inlet reduced to 30-35 kg/sq.cm, the slide valve is displaced by the spring, which affords communication between the cavities of the chamber.

Fluid is supplied into the hydraulic booster under pressure from the hydraulic system via two filters mounted in housing 1. Fluid outlet from the booster is via union 19. Housing 1 encloses slide valve 5 serving for engagement of the autopilot; when hydraulic fluid under a pressure of 24^{+3} kg/sq.cm is delivered via a union into the slide valve, the latter is displaced inside liner 6, compressing spring 4, cuts the distributing device of the main system off the working chamber of actuating cylinder 3, and causes hydraulic fluid from autopilot control unit AY-33E to be supplied into this chamber.

Hydraulic cylinder 3 consists of two chambers and is locked at both ends by bushes with gun-type locks. Pressed into both bushes are bronze shells receiving rods 2. One end of the rod terminates in an integral piston, the other end mounting detachable piston 8. Rod 2 serves to transmit the effort built up by the fluid to the controlled elements of the helicopter via a system of bell cranks.

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Cylinder 3 has two trunnions on its external surface; the trunnions are designed for mounting the cylinder in the bearings secured to the bracket. The cylinder is provided with an internal wall dividing it into two working chambers. The wall has a hole for the passage of the rod with three circular grooves; the two extreme grooves are fitted with sealing rings, the middle groove being intended for removal of the hydraulic fluid displaced by the rod.

All sealings in the hydraulic booster are made of round rubber rings 9 and flat fluoroplastic gaskets 10 preventing the rubber rings from being forced by hydraulic fluid pressure into the clearance between the mating components.

From the distributing device of the booster hydraulic fluid flows via passages in the bracket to a hollow stud, whence it is carried into one of the grooves machined on the cylinder trunnion surface, under the bearing. Then fluid enters the main working chamber via drilled passages in the trunnion and the cylinder body. Similar passages serve for hydraulic fluid outlet from the other cavity of the chamber. Hydraulic fluid flow from the distributing device to the duplicating cavity of the cylinder working chamber is along a similar path.

The hydraulic booster leverage system consists of output (actuating) bell crank 39 and input (control) bell crank 37 interconnected by stressed bolts 28 and 40 acting as axles of rotation. The travel of the control bell crank is limited by bush 36 press-fitted onto bolt 28.

The inner cavities of the bell crank bearings, as well as the clearance between limiting bush 35 and the input bell crank are protected by shaped washers. Output bell crank 39 is mounted on, and rotates about, cylindrical bolt 28 fastened in housing 1. Bolt 40 couples rod fork 41 to output bell crank 39 and input bell crank 37.

P r i n c i p l e o f o p e r a t i o n . From the helicopter main hydraulic system fluid is carried to the middle groove of distributing slide valve 18 through inlet union with filter 19 (Fig. 280); simultaneously, it flows via passage 17 to the face of cross-feed slide valve 16 which separates the cavities of the actuating cylinder main chamber. From the middle groove in slide valve 18 fluid enters hydraulic coupling 20 via holes; hydraulic fluid pressure causes bushes 26 enclosed in the hydraulic coupling to move apart, as a result of which the slide valve gets connected to the control lever system.

With distributing slide valve 18 in the neutral position (as shown on the diagram), its middle collars blank off the passages through which hydraulic fluid is carried into the main chamber of actuating cylinder 11. In this case, the servo rod remains motionless, although fluid is delivered under pressure into the unit distributing device.

When the pilot actuates through a system of levers input bell crank 1 which is capable of turning within the clearance between bolt 24 and bush 25 about axle 23 mounted on output bell crank 2, the movement is transmitted to slide valve 18 or 7 (depending on which of the hydraulic systems supplies pressure into the hydraulic booster) through link 22, levers 3 and 21, and links 4, as well as through hydraulic coupling 20 enclosing bushes. This causes the slide valve to move away from neutral.

When the slide valve moves off the neutral position, hydraulic fluid is supplied from the interslide cavity of the distributing slide valve into one of the actuating cylinder cavities through a system of passages made in bracket 6, the bracket studs, that secure the actuating cylinder bearings, bearings proper, and

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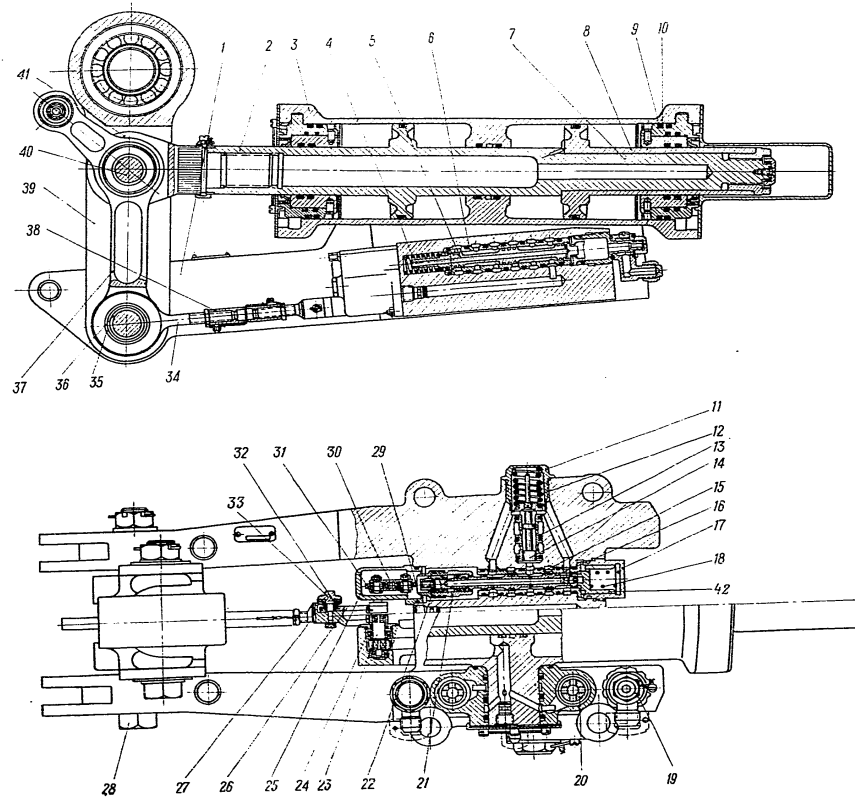


FIG. 279. HYDRAULIC BOOSTER BY-33A

1 - housing; 2 - rod; 3 - cylinder; 4 - spring; 5 - slide valve; 6 - liner; 7 - rod; 8 - detachable piston; 9 - rubber ring; 10 - fluoroplastic gasket; 11 - plug; 12 - spring; 13 - liner; 14 - slide valve; 15 - liner; 16 - slide valve; 17 - plug; 18 - spring; 19 - union; 20 - stud; 21 - coupling body; 22 - distance sleeve; 23 - axle; 24 - ball bearing; 25 - box; 26 - link; 27 - link; 28 - bolt; 29 - shackle; 30 - fork; 31 - lever; 32 - washer; 33 - eccentric bolt; 34 - tip; 35 and 36 - bushes; 37 - input bell crank; 38 - turnbuckle; 39 - output bell crank; 40 - stressed bolt; 41 - fork; 42 - hydraulic damper.

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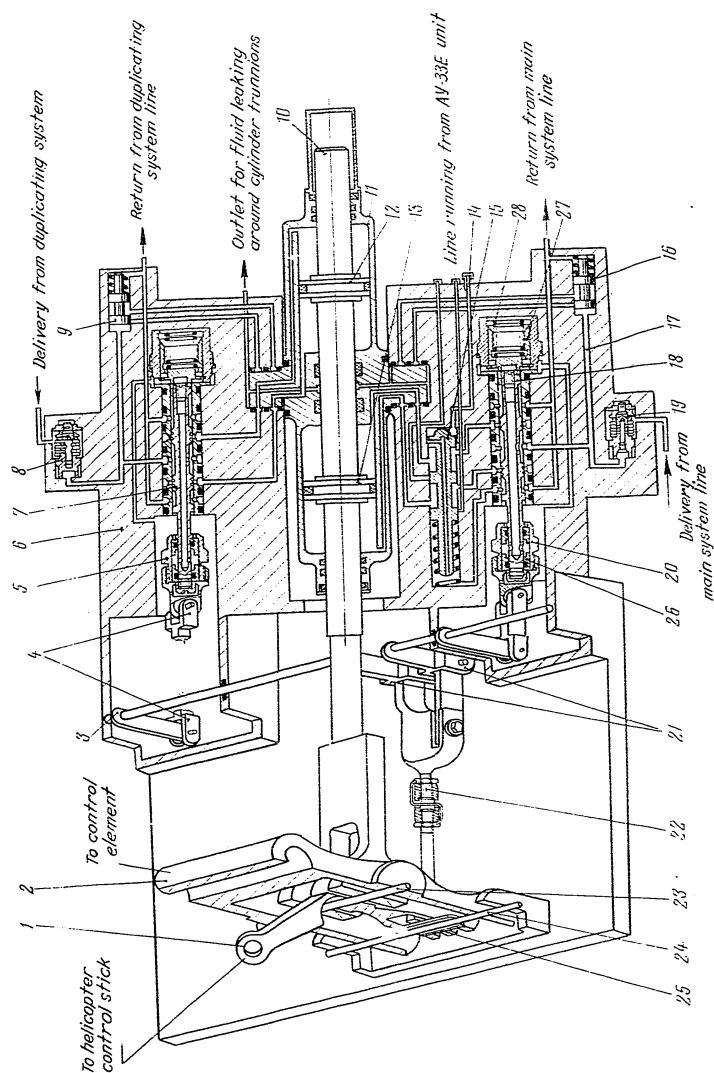


FIG. 280. SCHEMATIC DIAGRAM OF HYDRAULIC BOOSTER AV-33A
 1 - input bell crank; 2 - output bell crank; 3 - lever; 4 - link; 5 - hydraulic coupling; 6 - bracket; 7 - slide valve; 8 - filter; 9 - slide valve; 10 - servo rod; 11 - actuating cylinder; 12 - piston; 13 - union; 14 - union; 15 - filter; 16 - pilot slide valve; 17 - slide valve; 18 - slide valve; 19 - filter; 20 - hydraulic coupling; 21 - lever; 22 - link; 23 - axle; 24 - bolt; 25 - bush; 26 - hydraulic coupling bush; 27 - hydraulic damper; 28 - spring.

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the trunnions of cylinder 11. Hydraulic fluid pressure causes piston 13 to move to the right or to the left, depending on the direction of movement of distributing slide valve 18 or 7.

In the duplicating chamber of the cylinder, piston 12 displaces hydraulic fluid from one cavity into the other via slide valve 9 which, with no pressure in the duplicating system is pressed off by the spring thereby connecting both cavities of the actuating cylinder duplicating chamber.

Displacement of rod 10 causes actuation of output bell crank 2 connected to the helicopter control elements. When the pilot relieves pressure on input bell crank 1, the actuating cylinder rod and, hence, the output bell crank will continue moving until bell crank 1 travelling along with output bell crank 2 brings the clearance between bolt 24 and bush 25 to the initial value. In this case, slide valve 18 will assume the neutral position which will discontinue hydraulic fluid supply into one cavity and hydraulic fluid return from the other cavity of the actuating cylinder.

The helicopter mechanical control linkage incorporates an automatic change-over mechanism located upstream of the hydraulic booster; the mechanism operates to cut off the main hydraulic system thus causing hydraulic fluid to flow into the hydraulic booster from the duplicating system whenever the main distributing slide valve binds with the resulting increase of stresses on the helicopter control stick.

When the main hydraulic system is cut off, pressure between the bushes of hydraulic coupling 20 drops to the return one, causing the main slide valve to be disconnected from the control system. At the same time, slide valve 16 is actuated by the spring to connect both cavities of the actuating cylinder main chamber thereby providing free flow of fluid from one cavity into the other when the hydraulic booster is operated by the duplicating system.

Hydraulic booster operation from the duplicating system will proceed in the same manner as from the main hydraulic system.

With the autopilot switched on, the hydraulic boosters are supplied with working fluid from units AY-33E incorporating distributing devices similar to the distributing valve of the hydraulic booster; these devices are controlled by electric pulses produced by the autopilot. When the helicopter is controlled by the autopilot, hydraulic fluid is cut off slide valve 18 of the main system by applying a special signal to slide valve 15 via union 14. With the helicopter controlled by the autopilot, working fluid is supplied to the hydraulic boosters from the main system only.

Hydraulic Booster BY-32A

Basic Specifications

Distributing slide valve travel relative	
to point of connection with control link	2.5 ^{+0.5} mm
Servo rod travel	87 ± 1 mm
Maximum effort developed by	
hydraulic booster at output	
bell crank with p = 130 kg/sq.cm	
and rate of rod travel amounting	
to zero	at least 12,000 kg

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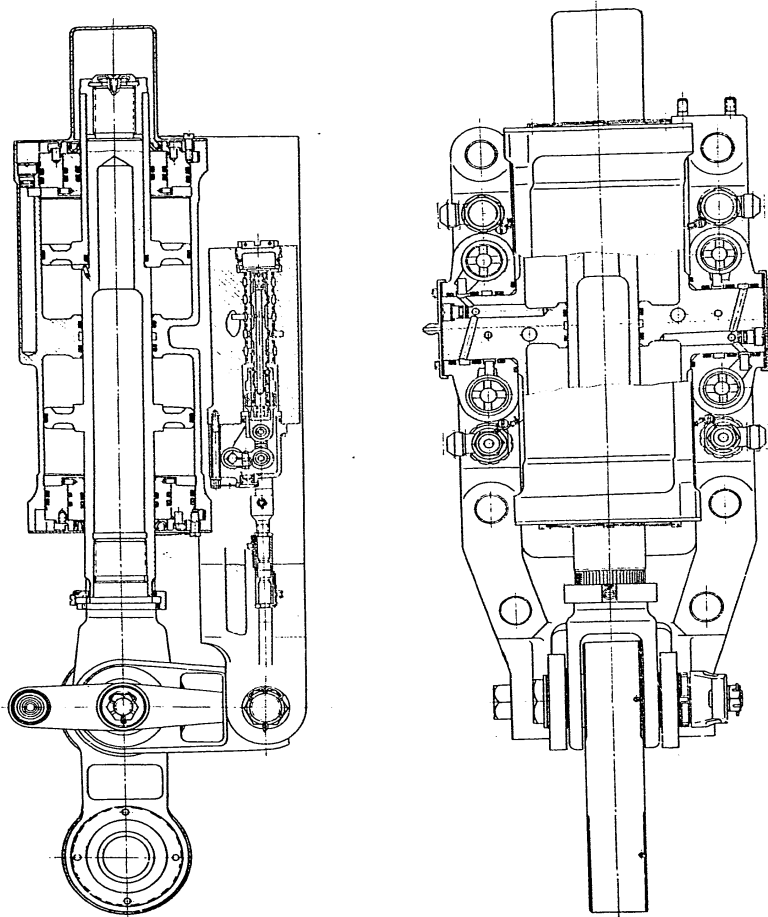


FIG. 281. HYDRAULIC BOOSTER EV-32A.

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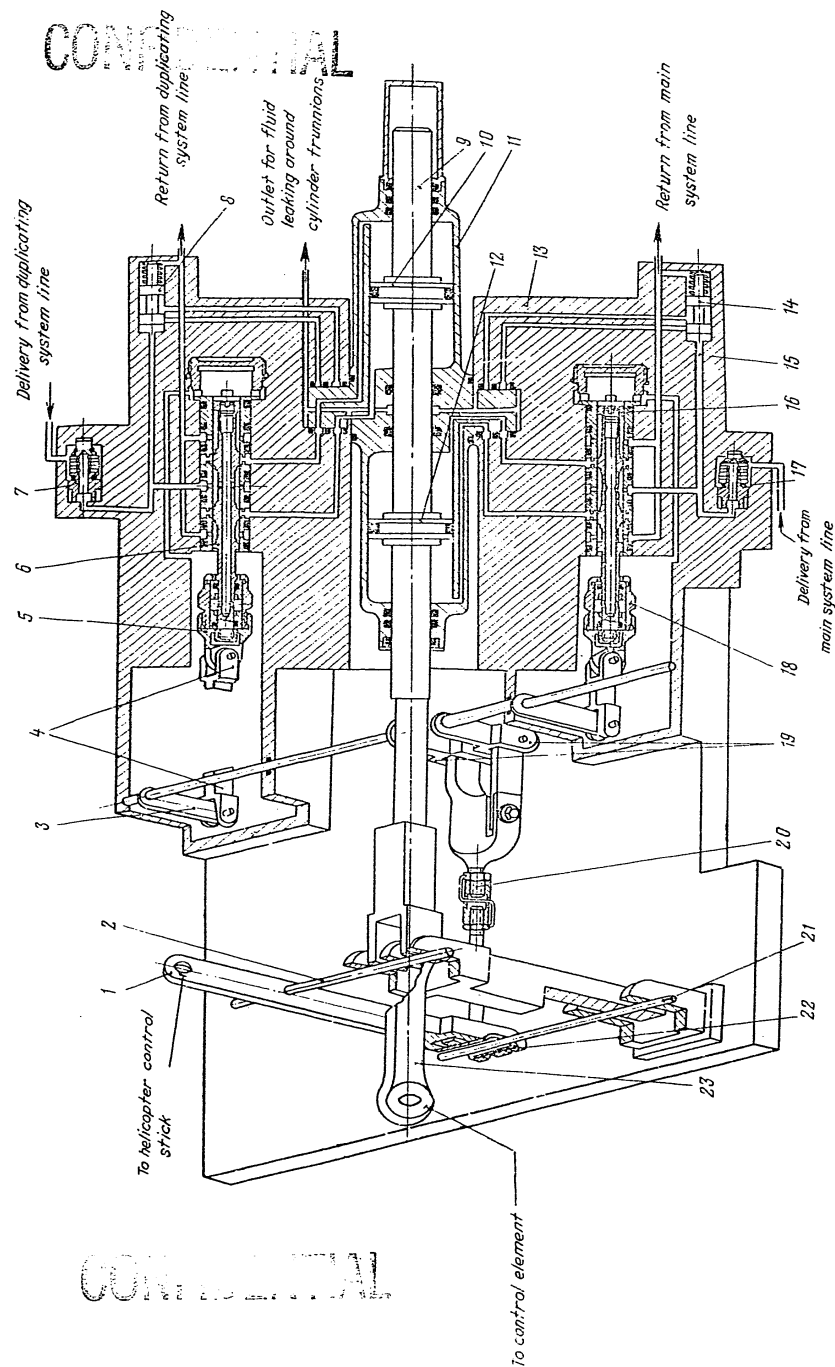


FIG. 282. SCHEMATIC DIAGRAM OF HYDRAULIC BOOSTER D572A

- 1 - input bell crank; 2 - axle; 3 - lever; 4 - link; 5 - hydraulic coupling; 6 - slide valve; 7 - filter; 8 - slide valve; 9 - servo rod; 10 - piston; 11 - actuator cylinder; 12 - piston; 13 - bracket; 14 - slide valve; 15 - passage; 16 - slide valve; 17 - filter; 18 - hydraulic coupling; 19 - lever; 20 - link; 21 - bolt; 22 - bush; 23 - link.

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Working fluid AMT-IO
 Fluid operating pressure 120 to 155 kg/sq.cm

The construction and operating principle of hydraulic booster EV-32A (Figs 281 and 282) are similar to those of hydraulic booster EV-33A, the only difference being that hydraulic booster EV-32A does not employ a slide valve which changes over hydraulic booster supply on receiving the autopilot signals; neither does it employ any hydraulic damper.

HYDRAULIC WING CONTROL MECHANISM FMK-1

Mounted at the fuselage starboard is hydraulic mechanism FMK-I controlling the wing; during helicopter powered flight the mechanism retains the wing at a specified positive angle of incidence. With the main rotor set to autorotation, the hydraulic mechanism brings the wing to another position involving a smaller angle of incidence relative to the fuselage reference line and keeps it in this position.

By manipulating the tumbler switch mounted on the control panel in the pilots cabin, the pilot switches on the FMK-I hydraulic mechanism which sets the wing in the respective position. Simultaneously, the tumbler switch changes over two valves 15 (see Fig.257) incorporated in the main and duplicating systems, thereby causing the wing to be raised or lowered. The valve arranged in the system, which is under pressure at the time, supplies working fluid into the hydraulic mechanism.

Basic Specifications

Servo rod travel 65 ± 2 mm
 Maximum effort retained by mechanism
 at fluid pressure of 115^{+5} kg/sq.cm and
 rod travelling rate amounting to zero at least 2500 kg
 Operating pressure 120 to 155 kg/sq.cm
 Working fluid AMT-IO

P r i n c i p l e o f o p e r a t i o n (Fig.283). When the main hydraulic system is in operation, hydraulic motor FM-34 is fed with working fluid via unions 15 and 17, whereas unions 16 and 18 are employed for fluid supply from the duplicating system. When the wing control mechanism is switched for supply over to the duplicating hydraulic system, signal pressure is supplied into union 12; hydraulic fluid exerts pressure on the face of slide valve 11 and causes the latter to go down against the force of spring 20; as a result, union 16 is connected to passage 5, and union 18, to passage 22.

When the main hydraulic system is employed, and there is no pressure in union 12, spring 20 keeps slide valve 11 in the extreme upper position; in this case, passage 5 is connected to union 15, and passage 22, to union 17. Union 19 is designed for outlet of the hydraulic fluid which seeps through clearances between the slide valve and the liner into the recess of spring 20.

Abrupt changes in the direction of the hydraulic motor rotation are likely to cause instantaneous excessive pressure surges in passage 5 or 22. To preclude this, provision is made for a maximum pressure limiting valve which, with an excessively

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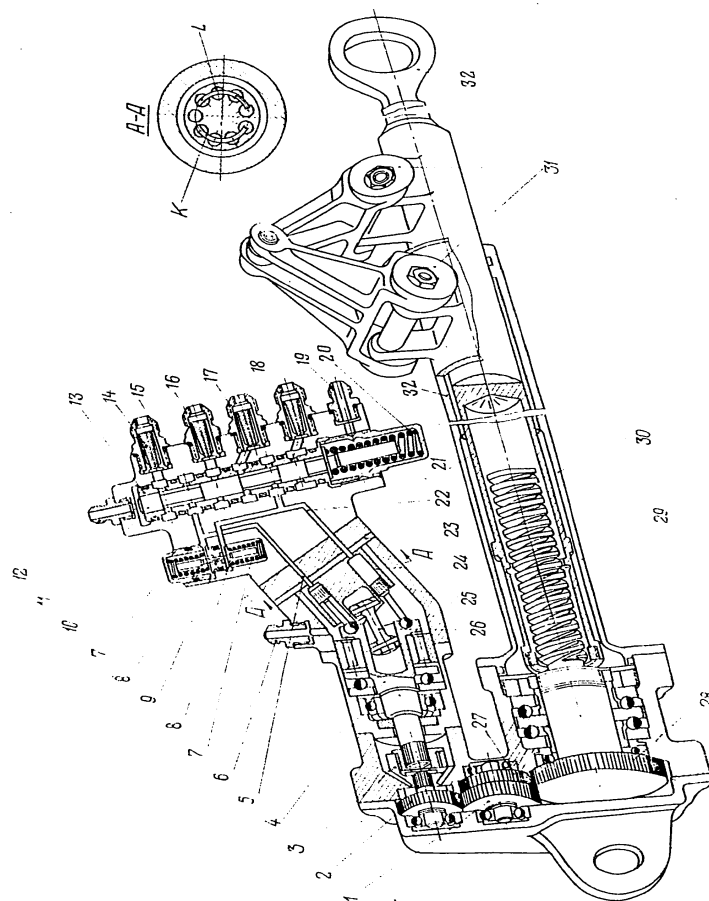


FIG. 283. HYDRAULIC WING CONTROL MECHANISM ГМК-1

1 and 2 - gears; 3 - coupling; 4 - hydraulic motor shaft; 5 - passage; 6 - vent valve; 7 - spring; 8 - guide; 9 - plunger; 10 - liner; 11 - slide valve; 12 - union for connection of duplicating system signal pipeline; 13 - filter; 14 - filter; 15 - and 17 - unions for connection of pipelines running from main hydraulic system valve ГЛ-21М/9; 16 and 18 - unions for connection of pipelines led from duplicating system valve ГЛ-21М/9; 19 - union for connection of vent pipeline; 20 - spring; 21 - rod; 22 - passage; 23 - hydraulic motor slide valve; 24 - cylinder block; 25 - piston; 26 - cam drive; 27 - gear; 28 - lead screw gear; 29 - lead screw; 30 - bush; 31 - levers; 32 - shank.

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high pressure built up, by-passes part of the fluid from passage 7 into passage 22, and vice versa (depending on where the excessively high pressure is developed).

When the main hydraulic system is in operation, working fluid is fed under pressure to union 15, passes through filter 14 and the holes in liner 13, and enters passage 5 whence it is carried into the piston holes of cylinders 24 via an arc-shaped groove milled in hydraulic motor slide valve 23.

Pistons 25 transmit working fluid pressure to hydraulic motor shaft 4. The axis of the cylinder block is positioned at some angle to the shaft axis; therefore, tangential components resulting from pressure developed by the pistons produce a torque, imparting rotation to shaft 4.

On their way inward, pistons 25 force working fluid through the piston holes into passage 22 and union 17 to direct the fluid into the return line. Union 6 serves for leaking working fluid outlet from the hydraulic motor to the return line.

Shaft 4 drives gear 2 to which it is connected through coupling 3. From gear 2 rotation is transmitted to gear 1 whose shaft mounts gear 27 in mesh with gear 28 of lead screw 29.

Screw 29 worms into rod 21, thereby displacing the rod in bush 30. Rod 21 is safeguarded against turning by levers 31 which articulate the rod to bush 30. Shank 32 rigidly coupled to rod 21 turns the helicopter wing from one extreme position to the other.

When pressure is supplied into union 17, hydraulic fluid enters passage 22, thereby causing the hydraulic motor shaft to rotate in the reverse direction, whereas fluid into the return line will flow from the hydraulic motor via passage 5 and union 15; as a result, the wing will be turned in the reverse direction.

SOLENOID-CONTROLLED HYDRAULIC VALVE IA-2IM/9

To control hydraulic mechanism IMK-I as well as to open and close the swivel lock of the sling system, use is made of three valves IA-2IM/9.

Basic Specifications

Working fluid AMT-10
Minimum valve operating pressure 10 kg/sq.cm
Voltage supplied to solenoid 22 to 27 V
Current drained by solenoid at 24 V 10 A, max.

P r i n c i p l e o f o p e r a t i o n (Figs 284 and 285). When right coil 18 is energized, armature 17 is attracted to limiter 19, thus assuming the extreme right-hand position. This done, slide valve 1 affords communication between the chamber under the left face of slide valve 14 and the return line. Fluid pressure in the boring under plunger 11 causes slide valve 14 to move to the extreme left-hand position, as a result of which chamber FROM PUMP (OT HACOCA) will be connected with union 1.

As soon as left coil 21 is energized, armature 17 is attracted to limiter 16, thus assuming the extreme left-hand position. Slide valve 1 will move to the extre-

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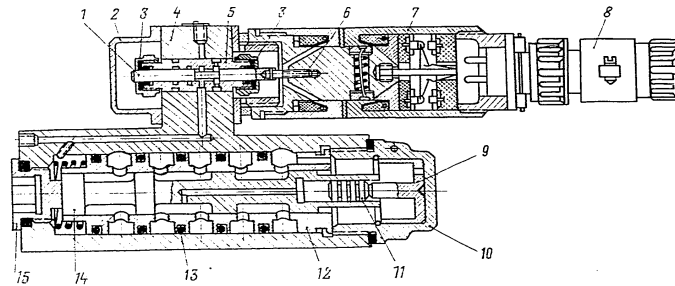


FIG. 284. SOLENOID-CONTROLLED HYDRAULIC VALVE 1'A-21M/9
 1 and 14 - slide valves; 2 - sleeve; 3 - rubber cup; 4 - housing; 5 and 12 - linkers;
 6 - link; 7 - solenoid; 8 - plug connector; 9 and 15 - stops; 10 - plug; 11 - plunger;
 13 - rubber ring.

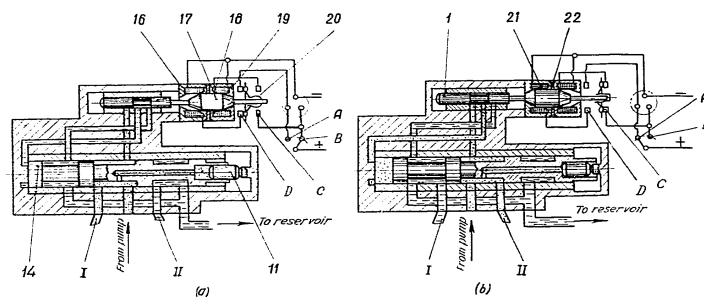


FIG. 285. 1'A-21M/9 VALVE OPERATING DIAGRAM
 1 and 14 - unions; (a) - switch has been operated to make contact B. Coil 18 is energized, armature is displaced to the right to work against switch C at end of travel, thereby breaking circuit; (b) - switch has been operated to make contact A. Coil 21 is energized, armature is displaced to the left to work against switch D at end of travel, thus breaking circuit.
 1 and 14 - slide valves; 11 - plunger; 16 - front limiter (front stop); 17 - armature; 18 - right coil; 19 - rear limiter (rear stop); 20 - microswitch; 21 - left coil; 22 - copper gasket.

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me left-hand position, too, thereby connecting the chamber under the left face of slide valve 14 with the high-pressure chamber. Slide valve 14 moves to the right to connect union 11 with chamber FROM PUMP.

As slide valve 14 is moving to the right, plunger 11 forces fluid out of the slide valve chamber through a small aperture, which somewhat delays the slide valve movement and alleviates the hydraulic impact resulting from the PA-2IM/9 valve engagement.

CONTROL OF CARGO COMPARTMENT DOOR PANELS AND LOADING RAMPS

The cargo compartment door panels and loading ramps (Fig.286) are hydraulically controlled by means of actuating cylinders and remote solenoid-operated hydraulic valves PA-I65.

The panel and door operation procedure is as follows. When the tumbler switch located in the flight engineer's cabin is manipulated, an electric pulse is applied to solenoid-operated hydraulic valve 6 (PA-I65) that is mounted on panel 4 arranged at the fuselage port side. From the valve hydraulic fluid flows into cylinder 10 which operates to open lock 11 clamping door panels 12. At the end of the piston travel a hole is opened in cylinder 10, through which the hydraulic fluid is supplied into cylinder 13 located in the tail boom.

Cylinder 13 opens the door panels through the medium of levers 15 and links 16. At the end of the cylinder rod travel, limit switch 14 is operated to feed a pulse to another PA-I85 valve (Ref.No.5) which supplies hydraulic fluid into cylinders 1 for lowering main ramps 7, and into cylinders 8, for hinging off end ramps 17.

To ensure proper sequence of operation when lowering main ramps 7 and end ramps 17, provision is made for retarding the flow of hydraulic fluid, that is leaving cylinder 1, with the aid of a non-return valve having a slot on its working surface (see Fig.273, Ref.No.2). The valve restricts the fluid flow only when the ramps are being lowered; with the ramps being raised, valve 2 opens to full capacity, thereby allowing free passage of the hydraulic fluid. Since the flow of hydraulic fluid is restricted in cylinders 1 (see Fig.286), cylinders 8 of end ramps 17 are filled first, which causes these ramps to be hinged off; next, ramps 17 are lowered onto the ground together with ramps 7.

To retract the ramps and close the cargo compartment door panels, it is necessary to operate the tumbler switch in the reverse direction; this will send a signal to valve 5 feeding hydraulic fluid into cylinders 1 for raising main ramps 7 and end ramps 17. When the ramps are fully raised, two interlocked limit switches 2 go in operation to supply a pulse to valve 6, after which hydraulic fluid enters cylinder 13, thereby closing the door panels. When the panels have been brought together, hydraulic lever-operated valve 9 (PA-35) is depressed, which causes hydraulic fluid to be carried into cylinder 10 for closing lock 11. The door panels fully closed, an electric limit switch operates, as a result of which the red light indicating the open position of the door panels goes out.

Incorporated in the loading ramp raising and lowering pipelines as well as in the cargo compartment door panel opening and closing pipelines are hydraulic locks 3, which keep the ramps raised and the door panels closed in case hydraulic fluid pressure in the system drops down.

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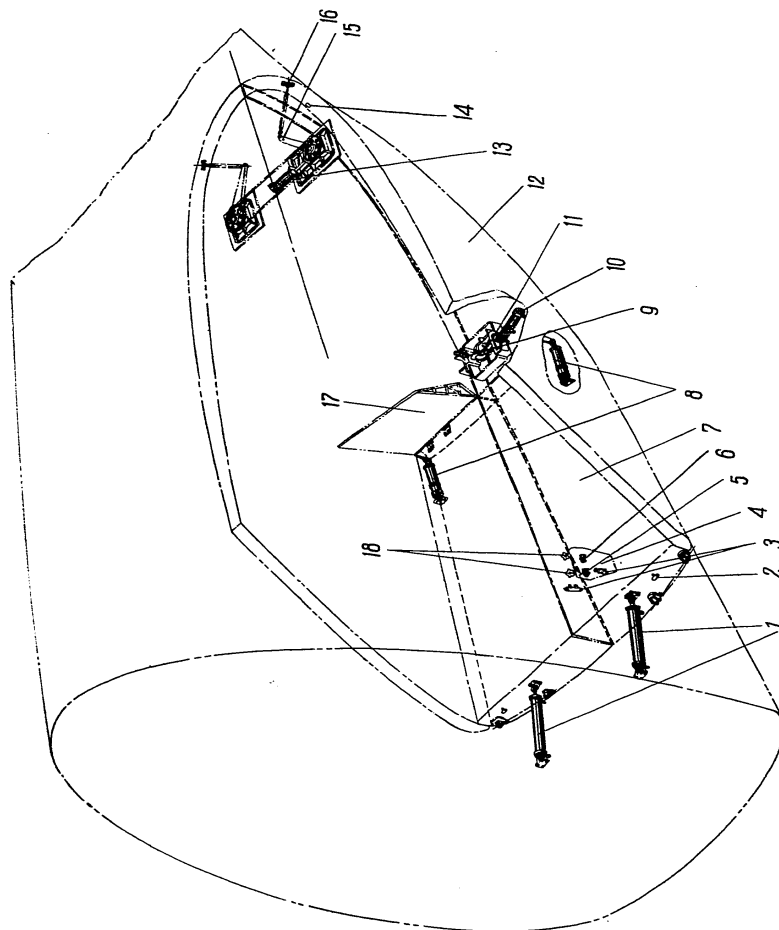


FIG. 286. DIAGRAM SHOWING ARRANGEMENT OF HYDRAULIC MECHANISMS CONTROLLING CARGO COMPARTMENT DOOR PANELS AND LOADING RAMP

1 - main loading ramp actuating cylinders; 2 - ramp limit switches; 3 - hydraulic lock T/A-88/6; 4 - panel mounting ramp and cargo compartment door panel hydraulic control units; 5 - solenoid-operated ramp control valve T/A-185; 6 - solenoid-operated door panel control valve T/A-185; 7 - main loading ramp; 8 - end loading ramp actuating cylinders; 9 - lever-operated valve T/A-35; 10 - lock actuating cylinder; 11 - lock; 12 - cargo compartment door panels; 13 - door panel actuating cylinder; 14 - limit switch; 15 - lever; 16 - link; 17 - end loading ramp; 18 - cargo compartment door panel and loading ramp manual control valves.

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Provision is also made for opening the door panels and ramps by means of manually controlled valves 18 which operate to connect both chambers of the panel and ramp actuating cylinders to the return line. In this case, lock 11 of the door panels is opened with the aid of a special socket wrench.

Two constructionally identical valves 18 carry three unions each and consist of a duralumin housing, a needle with a tapered projection, a nut, and other components (see Fig.289). The tapered projection on the needle is used to trap the fluid when the valve is fully closed and to by-pass it from the cylinder chambers into the reservoir with the valve being open.

Hydraulic cylinders 1, 8, and 13 are constructionally identical with the cylinders controlling cowl servicing platforms (Fig.298), the only difference being in their dimensions.

LEVER-OPERATED VALVE 1A-35

The lever-operated valve serves for feeding fluid under pressure into the cargo compartment door panel lock actuating cylinder (Fig.287) the moment the panels are approaching each other.

Principle of operation. Pressure is supplied from the system through union 13, union 14 being connected to the lock actuating cylinder. When pusher 1 is depressed, ball 8 is unseated, thereby connecting the chambers of unions 13 and 14.

HYDRAULIC LOCK 1A-88/6

Basic Specifications

Working fluid AMT-10
Operating pressure 120 to 150 kg/sq.cm
Pressure causing thermo-sensitive valves to open 200 kg/sq.cm

Principle of operation. Housing 1 (Fig.288) accommodates two non-return valves 2 enclosing floating piston 3 kept in the neutral position by helical springs 4. When fluid flows under pressure from valve 1A-185 into passage 5 (diagram II), right-hand non-return valve 2 opens, as a result of which fluid enters the actuating cylinder through passage 6. Simultaneously, piston 3 is displaced by fluid pressure to the left to open left-hand non-return valve 2, thus providing a passage-way for the fluid carried from the non-operating chamber of the cylinder via passages 8 and 9.

When the valve is switched over for fluid supply into passage 8, the lock operates in a similar manner though in the reverse direction.

When there is no fluid flow from the valve, non-return valves 2 trap the fluid in the cylinder to prevent any displacement of the actuating cylinder pistons.

The hydraulic lock employs thermo-sensitive reducing valves 7 which open to by-pass fluid when pressure in the cylinder comes to exceed the operating value by 50 kg/sq.cm.

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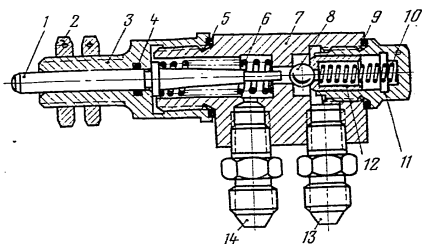


FIG. 287. LEVER-OPERATED VALVE ΓA-35
1 - pusher; 2 - nut; 3 - guide; 4 - rubber ring; 5 and 9 - sealing washers; 6 and 10 - springs; 7 - housing; 8 - ball; 11 - plug; 12 - support; 13 and 14 - unions.

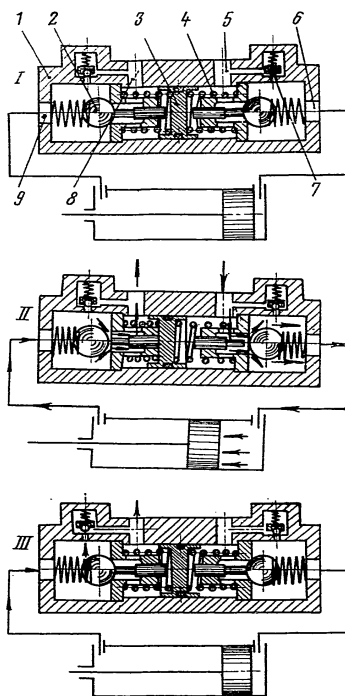


FIG. 288. HYDRAULIC LOCK ΓA-88/6
I - hydraulic fluid supply into cylinder is cut off, cylinder chambers are locked; II - hydraulic fluid is supplied into cylinder right-hand chamber, left-hand chamber being connected to return line; III - pressure in cylinder (left-hand chamber) rises above operating value, causing thermo-sensitive valve to operate
1 - housing; 2 - valve; 3 - piston; 4 - spring; 5 and 8 - chambers connected to valve ΓA-185; 6 and 9 - chambers connected to hydraulic cylinder; 7 - valve.

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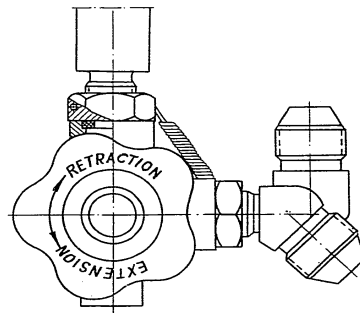
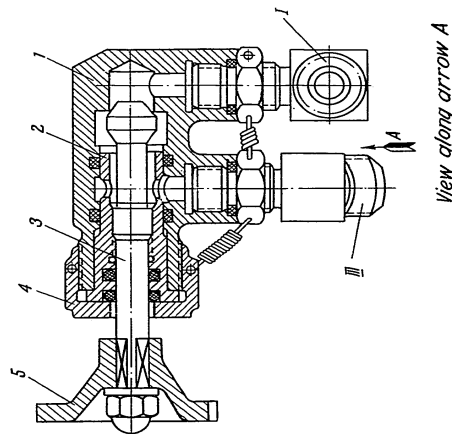
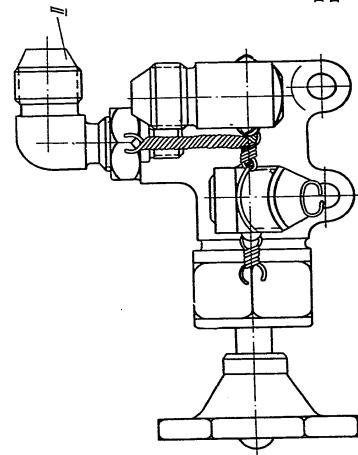


FIG. 289. LOADING RAMP MANUAL CONTROL VALVE
1 - housing; 2 - bush; 3 - needle; 4 - nut; 5 - knob.



View along arrow A



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LOADING RAMP MANUAL CONTROL VALVE

The valve consists of housing 1 (Fig.289), bush 2, needle 3, nut 4, knob 5, and three unions. Sealing is provided by rubber rings.

Principle of operation. When the hydraulic system operates normally, the valve is closed and unions I, II, and III do not communicate with one another. In case the hydraulic system fails, it is necessary to turn the valve knob as far as it will go; this will cause unions I, II, and II to be connected to the return line, as a result of which the ramps will start opening by gravity.

REDUCING VALVE PA-159

The valve is designed for reducing the operating pressure of hydraulic fluid from 120-150 kg/sq.cm to 60 kg/sq.cm to be supplied to the locking system of the collective pitch-throttle control lever, the pilots' seat hydraulic actuating cylinders, and the fan adjustable blade actuating cylinders.

Basic Specifications

Operating pressure supplied 120 to 150 kg/sq.cm
 Reduced pressure maintained by valve 60 ± 5 kg/sq.cm
 Valve operating pressure (when acting as safety valve) 80 ± 8 kg/sq.cm

Principle of operation (Figs 290 and 291). Hydraulic fluid under high pressure is supplied into the reducer via union 6, while fluid under reduced pressure is carried into the system via union 8. Fluid accumulating as a result of internal leaks is directed into the return line through union 1. Chamber A contains fluid under reduced pressure which is supplied into the system; the reduced pressure value is a function of the effort required for spring compression.

The reduced pressure is maintained at a constant value due to the following: if pressure in the system increases, the slide valve will be displaced to the left by pressure in chamber A. This will cause restricting slot B to decrease, thus offering a higher resistance to the fluid; as a result, the reduced pressure will decrease, too. In case pressure in the system drops off, spring 2 will shift slide valve 9 to the right, thereby widening the restricting slot. This will result in lower resistance to the fluid, and the reduced pressure in the system will rise.

In case there is no fluid flow in the reduced pressure system, the reducer functions as a safety valve, i.e., when pressure in chamber A increases, the slide valve moves to the left, thus connecting chamber A to the return line.

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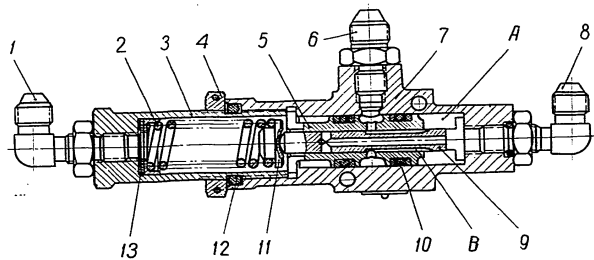


FIG. 290. REDUCING VALVE $\Gamma A-159$
 1, 6, and 8 - unions; 2 - spring; 3 - sleeve; 4 - nut; 5 - liner; 7 - housing;
 9 - slide valve; 10 and 12 - rubber rings; 11 - support; 13 - adjusting
 washer.

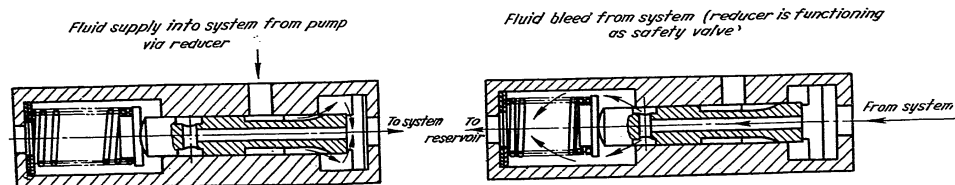


FIG. 291. SCHEMATIC DIAGRAM OF REDUCING VALVE $\Gamma A-159$.

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COLLECTIVE PITCH-THROTTLE CONTROL LEVER FRICTION CLUTCH

To ensure stepless movement of the collective pitch-throttle control lever (see "Helicopter Control System", Fig.202), the lever axle mounts a spring-loaded friction clutch. The springs are pressed off by piston 17 which is acted upon by the pressure of hydraulic fluid supplied from solenoid-controlled valve 1A-192 arranged under the pilot's seat. Pulses are applied to the valve by depressing button 8 mounted on the face of the collective pitch-throttle control lever. With the button depressed, solenoid-controlled valve 1A-192 feeds hydraulic fluid to piston 17 which presses off the springs; as soon as the button is released, the piston returns to the initial position, and the springs lock the collective pitch-throttle control lever through the medium of a plate.

PILOT'S SEAT CONTROL

Seat raising and control of the backrest tilt is accomplished by turning the handle of the seat control valve (Fig.292) to the respective position. When handle 7 is turned forward (Fig.294), the seat is raised; after the valve handle is released, the seat remains in the same position. To lower the seat, handle 7 should be turned backward.

To tilt the backrest forward, handle 8 is turned forward and vice versa.

Attached to the backrest rear is mechanism 7 (see Fig.292) intended for locking the pilot's safety harness. Prior to leaning to the instrument panel, the pilot turns the handle mounted on the backrest axle; the handle releases the mechanism, thus enabling the pilot to lean forward. As soon as the pilot leans back to the initial position, the safety harness gets locked.

The hydraulic system controlling the pilots' seats is switched off by means of valve 1A-230.

PILOT'S SEAT ACTUATING CYLINDER

Cylinder 1 is attached to bracket 3 (Fig.292). Reciprocating inside the cylinder is a piston with rod 2 to which the seat pan is coupled. Cylinder lower chamber I is connected by a pipeline to the valve, upper chamber II being connected right to the hydraulic system delivery line.

When fluid from the valve flows into lower chamber I, the seat goes up and fluid from upper chamber II is displaced into the hydraulic accumulator. In case lower chamber I is connected to the reservoir via the valve, the seat will be lowered at the expense of the pilot's weight and fluid pressure in upper chamber II. To prevent fluid leakage through the seat valves into the reservoir when the hand pump is being operated, provision is made for a cut-off valve.

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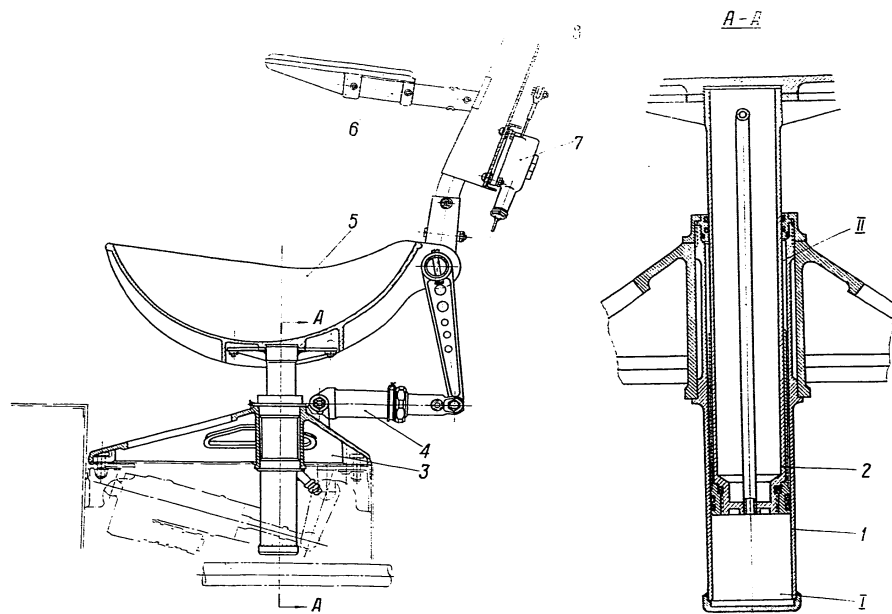


FIG. 292. PILOT'S SEAT

1 - cylinder; 2 - rod; 3 - bracket; 4 - back-rest tilting cylinder; 5 - seat pan; 6 - arm rest; 7 - safety harness locking mechanism; 8 - backrest.

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SEAT BACK-REST TILTING CYLINDER

To lock the back-rest in any position within its travelling range, provision is made for a cylinder enclosing a hydraulic lock. Chambers I and II of the cylinder (see Fig.293) are connected via passages in the piston to unions 5 and 6 which communicate with the control valve through pipelines. Moving inside cylinder I is piston 4 accommodating two valves 2 and 7 forced against their seats by springs 3 and 8. With an external force applied, piston 4 is not displaced since the chambers holding hydraulic fluid are locked by valves 2 and 7; when hydraulic fluid is supplied from the control valve, valve 7 is unseated, thus allowing fluid flow into chamber I. From chamber II hydraulic fluid passes into the reservoir via valve 2 which is unseated by piston 9 at the expense of hydraulic fluid pressure supplied via the control valve.

SEAT CONTROL VALVE

The valve controlling seat raising and lowering as well as back-rest tilt (Fig.294) comprises housing 5 mounting two handles.

Handle 8 serves for controlling back-rest tilt via slide valve 4 which is, essentially, a cylinder provided with holes and grooves. With the handle set in the middle position, unions 10 and 12 are connected to the reservoir, whereas with the handle in one of the extreme positions, one of the unions (Ref.No.10 or 12) is connected to the delivery line, the other union communicating with the return line, and vice versa. In this way hydraulic fluid is supplied under pressure into cylinder chamber I or II (see Fig.293).

Handle 7 (Fig.294) is designed for control of seat raising and lowering. When the handle is set in the middle position, hydraulic fluid is locked by valve 3 inside union 6. With handle 7 turned forward, slide valve 1 is turned, too; as a result, hydraulic fluid is supplied under pressure to the face of valve 3. The fluid unseats the valve to enter cylinder lower chamber I, thereby raising the seat (Fig.292).

When the handle is turned in the reverse (backward) direction, the cams provided on slide valve 1 (see Fig.294) slide on the cams of nut 2; due to this, the slide valve moves down to press valve 3 off the seat of locking nut 13. At the same time, the holes in slide valve 1 are matched in a manner allowing chamber I (see Fig. 292) to communicate with the system return line; as a result, hydraulic fluid from union 6 is capable of flowing into the reservoir, which involves seat lowering.

CONTROL OF FAN ADJUSTABLE BLADES

To reduce the time required for closing the adjustable blades of the fan and to ensure more effective fire extinguishing, provision is made for hydraulic cylinder 46 (Fig.257) and solenoid-operated valve 45 of the IA-I63 type which is automatically controlled from the fire-fighting system electric circuit. Hydraulic cylinder 46 controlling fan blade turning is similar in construction to the

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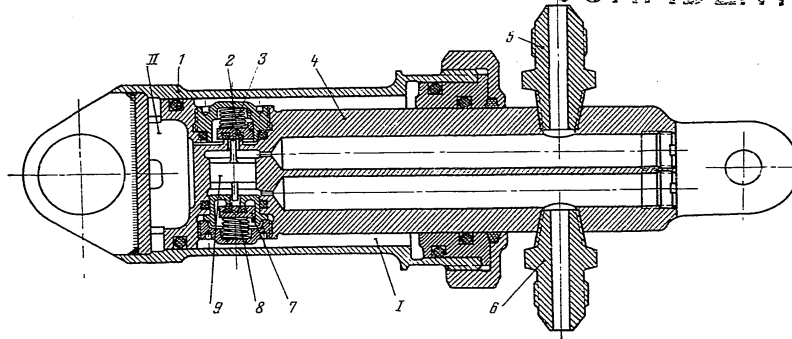


FIG. 293. SEAT BACK-REST TILTING CYLINDER WITH HYDRAULIC LOCK
1 - cylinder; 2 and 7 - valves; 3 and 8 - springs; 4 - piston; 5 and 6 - unions; 9 - piston.

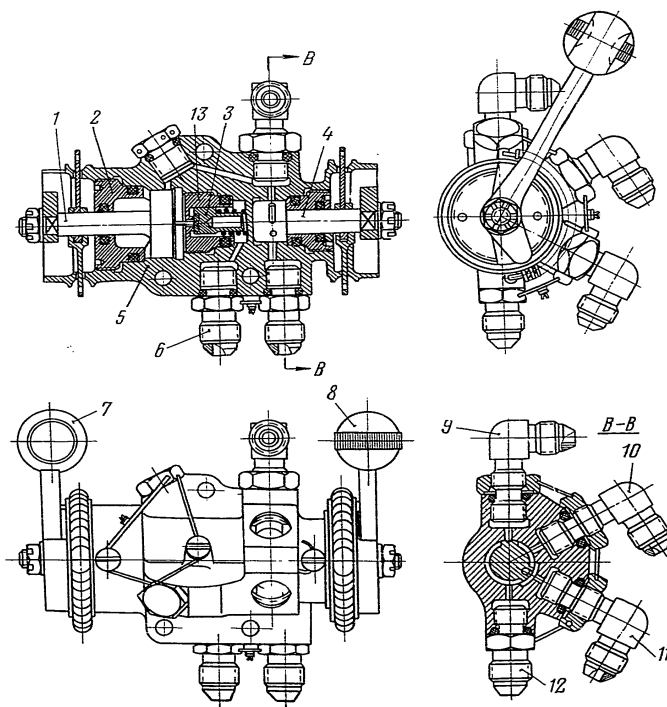


FIG. 294. PILOT'S SEAT AND BACK-REST TILT CONTROL VALVE
1 - slide valve controlling seat raising and lowering; 2 - nut; 3 - valve; 4 - slide valve controlling backrest tilt; 5 - housing; 6 - union; 7 and 8 - handles; 9 - union for connection of delivery pipelines; 10 and 12 - unions for connection of pipelines running from back-rest tilting cylinder; 11 - union for connection of return pipe line; 13 - locking nut.

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hydraulic cylinder of the sling system lock (see Fig.310). The hydraulic cylinder rod is kept extended at all times, being retained by a ball lock and the pressure of the hydraulic fluid supplied from the hydraulic valve IA-163.

When fire occurs, hydraulic valve IA-163 will automatically operate (the valve is connected into the fire-fighting system electric circuit) to by-pass hydraulic fluid into hydraulic cylinder union II to cause the rod to be retracted, and the fan blades, closed.

After the fire is put out and the temperature in the gear box compartment is reduced, the fire alarm system will operate to set hydraulic valve IA-163 to the initial position; the valve will supply hydraulic fluid into union I, thereby extending the rod and opening fan blades.

SOLENOID-CONTROLLED HYDRAULIC VALVE IA-163

The valve is designed for switching over hydraulic fluid supply of the cylinder for opening or closing the fan adjustable blades.

Basic Specifications

Working pressure in system 60 kg/sq.cm

Resistance to fluid flow offered

by return line 20 kg/sq.cm, max.

Operating duty of energized valve continuous

Supply voltage 27 V $\pm$ 10%

The IA-163 three-position solenoid-controlled valve incorporates two valve devices operated by solenoids.

A common housing accommodates two identical valve distributing devices employing delivery union No.1 and return union No.4 (Fig.295).

The distributing valve solenoid windings are connected to a plug connector. When the contacts are dead, the sharp edge of slide valve 33 is forced by spring 37 against the tapered surface of liner 32. In this case, union No.1 is locked, unions Nos 2 and 3 being connected to union No.4.

With voltage applied to contact 2 of plug connector 24, solenoid armature 21 displaces slide valve 33 to the left through the medium of pusher 27. The sharp edge of slide valve 33 works against the tapered surface of seat 5, thereby connecting union No.1 to union No.2.

Energizing contact 3 causes operation of the other distributing valve, the sequence of events being the same as just detailed above. In this case, union No.1 will be connected to union No.3.

CONTROL OF COWL SERVICING PLATFORMS

The cowl servicing platforms are opened and closed with the aid of ten actuating cylinders (Fig.298) and two hydraulic system valves mounted on panels.

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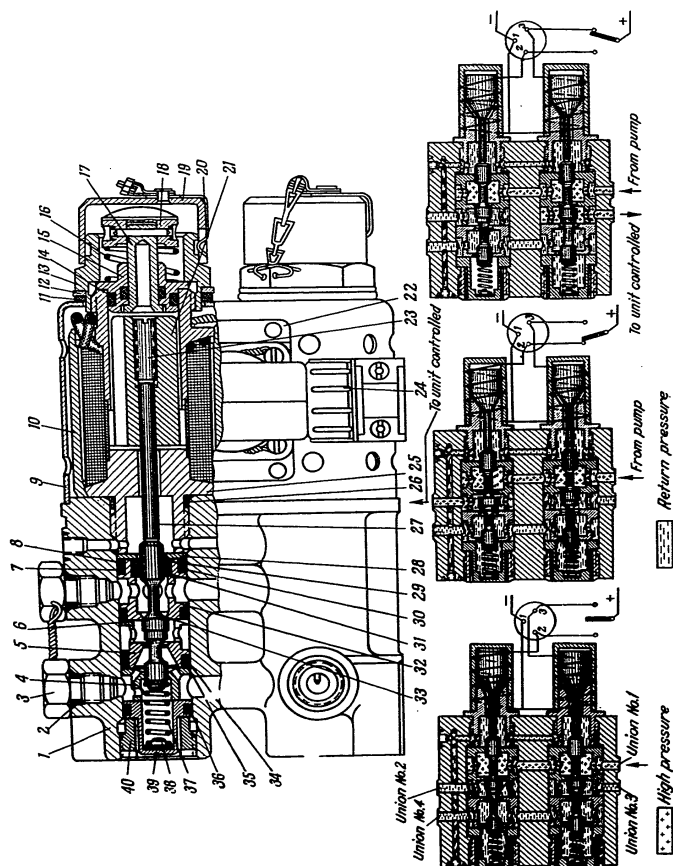


FIG. 295. SOLENOID-CONTROLLED VALVE 1X-163

1 - housing; 2 - rubber ring; 3 - nut; 4 - washer; 5 - seal; 6 - bush; 7 - seal; 8 - nut; 9 - washer; 10 - seal; 11 - nut; 12 - washer; 13 - nut; 14 - rubber ring; 15 - bush; 16 - seal; 17 - nut; 18 - washer; 19 - seal; 20 - nut; 21 - washer; 22 - nut; 23 - solenoid; 24 - spring; 25 - valve core; 26 - seat; 27 - nut; 28 - washer; 29 - seal; 30 - nut; 31 - washer; 32 - nut; 33 - washer; 34 - nut; 35 - seal; 36 - nut; 37 - seal; 38 - nut; 39 - seal; 40 - nut.

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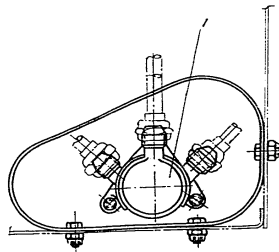


FIG. 296. COWL SERVICING PLATFORM CONTROL PANEL
1 - cowl platform control valve.

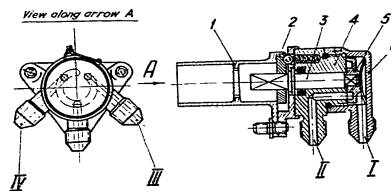


FIG. 297. COWL SERVICING PLATFORM CONTROL VALVE
I - union for connection of delivery pipeline; II - union for connection of return pipeline; III and IV - unions for connection of pipelines running from hydraulic cylinders; 1 - sleeve; 2 - limiting carrier; 3 - axle; 4 - housing; 5 - flat slide; 6 - cover.

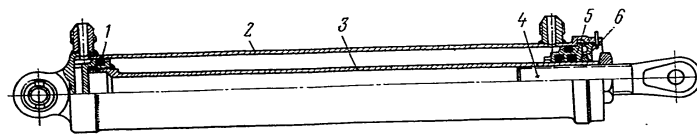


FIG. 298. COWL SERVICING PLATFORM ACTUATING CYLINDER
1 - sealing ring; 2 - cylinder; 3 - rod; 4 - fork; 5 - box; 6 - nut.

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Valves 1 (Fig.296) are installed in the front part of the engine cowl and are controlled manually by operating the handle made in the form of a folding wrench.

To accommodate the valve handle for opening the platforms, provision is made for a recess with stencilled inscription arranged in the fairing of the engine cowl front part.

By operating one valve, all of the five cowl platforms on one side can be simultaneously opened or closed. Should it become impossible to hydraulically open the platforms (in the event there is no fluid in the hydraulic system), each platform can be opened manually.

The platform control system incorporates metering valves 1A-175 (Fig.299) which prevent hydraulic fluid outflow (in excess of 3.2 lit) from the auxiliary system reservoir in case the pipeline supplying fluid to the platform actuating cylinders is damaged.

COWL SERVICING PLATFORM CONTROL VALVE

The valve (Fig.297) consists of bronze housing 4, steel flat slide 5 provided with distributing passages on its face, cover 6, axle 3, limiting carrier 2, sleeve 1, and other parts.

When axle 3 is turned to the extreme right-hand position (looking along arrow A) by means of a folding detachable handle, carrier 2 and flat slide 5 will be turned, too. This will cause hydraulic fluid to be supplied under pressure from union I into union III, whereas from union IV fluid will flow into the return line via union II.

With the valve set in the other extreme position, hydraulic fluid will be carried from union I into union IV, whereas fluid from union III will flow into the return line. As a result, hydraulic fluid will enter the cylinders to have the platforms opened or closed. For locking the carrier, the valve encloses a ball with a spring.

To prevent accidental turning of axle 3, the valve detachable handle is kept in the helicopter tools bag.

COWL SERVICING PLATFORM ACTUATING CYLINDER

Each cowl platform is opened and closed with the aid of one hydraulic cylinder (Fig.298) consisting of cylinder 2, rod 3, box 5, fork 4, nut 6, and other parts.

Mounted at one end of the rod is a piston with rubber ring 1, the other end terminating in fork 4. Cylinder 2 is provided with two unions arranged at its ends for connection of the pipeline. One end of the cylinder mounts a welded eye, whereas the other end accommodates box 5 with sealing rings, clamped by nut 6.

METERING VALVE 1A-175

The hydraulic pipeline system arranged in the engine compartment incorporates four metering valves 1A-175.

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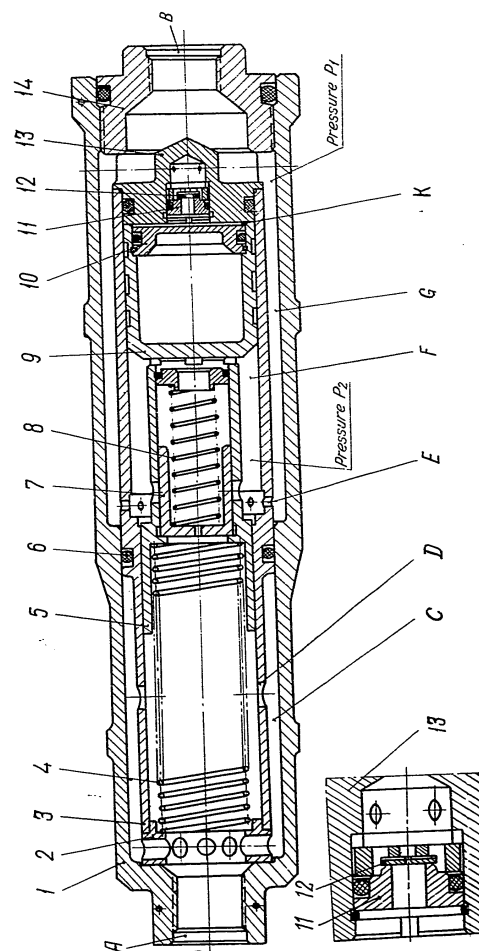


FIG. 299. METERING VALVE $\Gamma A-175$

1 - housing; 2 - stop; 3 - liner; 4 and 8 - springs; 5 - slide valve; 6 - rubber ring; 7 - non-return valve; 9 - valve; 10 - piston; 11 - seat; 12 - diaphragm; 13 and 14 - plugs.

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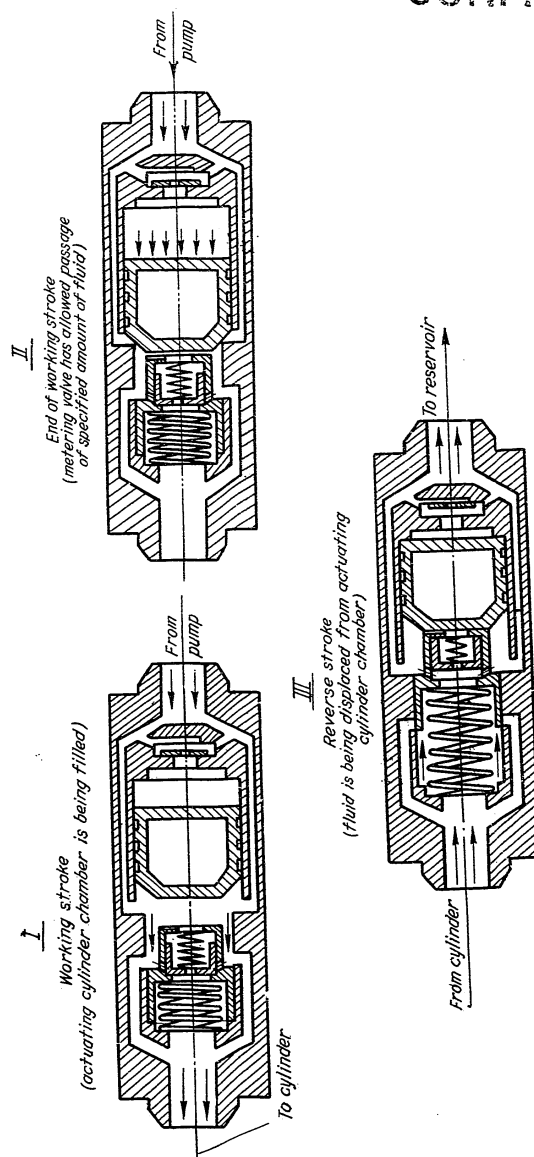


FIG. 300. SCHEMATIC DIAGRAM OF METERING VALVE PA-175.

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Basic Specifications

Hydraulic fluid AMT-10
 Operating pressure 120 to 155 kg/sq.cm
 Minimum volume metered 2000 cu.cm
 Maximum volume metered at hydraulic
 fluid temperature of +90°C 3200 cu.cm

P r i n c i p l e o f o p e r a t i o n (Figs 299 and 300). When pressure is supplied to chamber B, a certain amount of hydraulic fluid will leave chamber A, after which fluid flow will be cut off by valve 9. Unobstructed fluid flow is allowed in the reverse direction (from chamber A to chamber B).

The principle of hydraulic fluid metering is based on the following: hydraulic fluid entering union B flows from chamber G into chamber F via calibrated apertures Y provided in liner 3. Fluid pressure forces slide valve 5 to the extreme left-hand position, as a result of which a stream of fluid is allowed to pass through apertures D into chamber C and thence into union A via apertures drilled in step 2.

When hydraulic fluid flows through apertures E, a pressure differential amounting to p_1-p_2 is built up. The same pressure differential is built up on both sides of diaphragm 12. Exerted on the right side of the diaphragm is pressure p_1 , whereas pressure exerted on the left side of it comes to amount to p_2 since the weight of valve 9 approaches the weight of the fluid displaced by it; besides, valve movement involves little friction, thus transmitting pressure in the same manner as a soft membrane would do. As a result of established pressure differential p_1-p_2 , chamber K is filled with fluid, and valve 9 moves to the left.

After the diaphragm allows the passage of an amount of fluid required for full travel of the valve, the latter comes up against the liner seat, thereby shutting off the main stream of fluid. At any rate of fluid flow through the unit, pressure differential p_1-p_2 , though changing in value, remains constant for aperture E and for the diaphragm. The ratio between the amounts of fluid passing through aperture E and through the diaphragm remains, therefore, constant at any rate of fluid flow. Until valve 9 is locked, the diaphragm always allows the passage of the same amount of fluid equalling the valve passage area multiplied by valve travel; the amount of fluid passing through aperture E and, consequently, through the entire metering unit should, therefore, be constant, too.

The diagrams presented in Fig.300 illustrate the metering unit operation. Diagram I shows the position of the metering unit components during the working stroke (valve 9 is in an intermediate position, moving to the left). Presented in diagram II is the position occupied by the parts after valve 9 has come up against the liner seat. Diagram III shows the reverse flow of fluid opening non-return valve 7. In this case, the diaphragm comes off the seat, thus allowing free passage of fluid from chamber K.

WINDSHIELD WIPERS ΓA-211

The front side glass panels of the pilots' cabin mount two hydraulically driven windshield wipers 1 (see Fig.258).

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Basic Specifications

Working pressure 120 to 155 kg/sq.cm
 Number of brush double strokes per min 100 to 200
 Effort with which brush is pressed
 against glass 2 to 2.5 kg

Starting or stopping of the windshield wipers, as well as adjustment of the brush travel speed is done with the aid of throttle valves 4 which are located on the sides of the pilots' cabin. Fluid is supplied into the windshield wipers from the auxiliary hydraulic system via throttle valves 4.

P r i n c i p l e o f o p e r a t i o n . Working fluid is fed under pressure from the hydraulic system into the right-hand chamber of liner 4 (Fig.301) via delivery union 12. The left-hand chamber of the liner is connected by the left valve to the return union via the chamber of the change-over mechanism. As a result, piston 1 moves to the left, thereby rotating gear 2 in the clockwise direction, which, in turn, causes rotation of drive shaft 3 with the brush carrier fitted on it.

The change-over mechanism operates in the following manner: drive washer 11 splined to drive shaft 3 rotates together with the latter to work screw 7 against clamp 9 and turn the clamp clockwise. Due to this, spring 10 expands and, after passing through the dead centre, compresses to overcome the force of friction and shift strip 5 to the other extreme position. Strip 5 switches over valves 6 pressed to both sides of it by high pressure. As a result, the piston starts moving in the reverse direction.

The construction of the windshield wiper brush (Fig.302) involves parallel movement of the latter. The brush mechanism functions in the following way: drive carrier 2 is turned by the drive shaft on whose splines the carrier is fitted. In its middle part the drive carrier is articulated to driven carrier 3 which is, in turn, articulated to brush 1 and web 4.

Now, brush 1 is hinged in the middle portion to the end of drive carrier 2, and in the upper portion, to the end of driven carrier 3. Turning of the drive carrier and the brush causes turning of the driven carrier which provides for parallel movement of the brush.

THROTTLE VALVE 1A-230

Throttle valves 1A-230 are designed for switching on and adjusting the flow of hydraulic fluid supplied into the drive mechanism of windshield wiper 1A-2II and for controlling fluid supply into the pilots' seat actuating cylinders.

Basic Specifications

Working fluid AMT-10
 Operating pressure 120 to 150 kg/sq.cm

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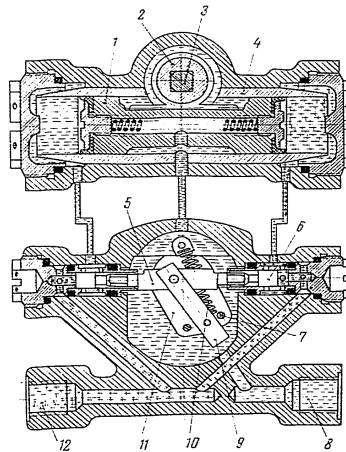


FIG. 301. WINDSHIELD WIPER ΓA-211
1 - piston; 2 - gear; 3 - drive shaft; 4 - liner; 5 - strip;
6 - valve; 7 - screw; 8 - return union; 9 - clamp; 10 -
spring; 11 - drive washer; 12 - delivery union.

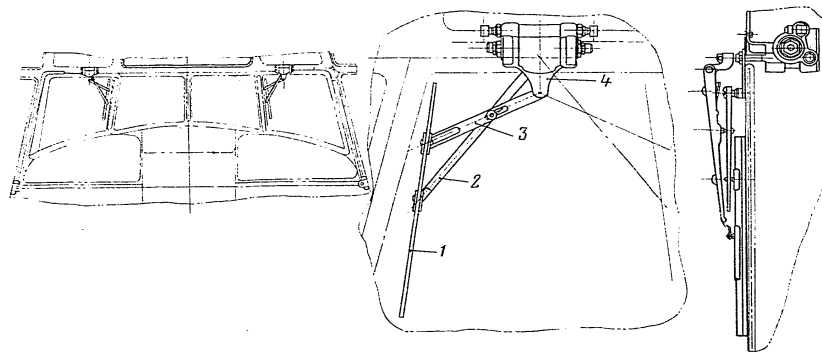


FIG. 302. WINDSHIELD WIPER BRUSH
1 - rubber brush; 2 - drive carrier; 3 - driven carrier; 4 - web.

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P r i n c i p l e o f o p e r a t i o n (Fig.303). Switching of, and adjusting the double stroke number in, the windshield wiper are done by turning hand-wheel 4, which changes the passage area of the valve and, consequently, the fluid flow. The fluid carried into the valve via union I passes in succession through three adjustable small area passages. The first adjustable passage is formed by the circular clearance between housing 1 and needle 5; the other two passages are drilled in liner 8 to be partially blanked off by limiter 7. The extreme position of the limiter corresponds to the maximum flow of fluid allowed by the valve when the needle is fully open. Besides, the needle adjusts fluid flow through union II from zero to maximum (as set by means of limiter 7).

SOLENOID-CONTROLLED VALVE Γ A-192

Unlocking of the collective pitch-throttle control lever and controlling of hydraulic fluid supply into the autopilot are both accomplished with the aid of solenoid-controlled valves Γ A-192.

Basic Specifications

Working fluid	AMT-10
Maximum operating pressure	155 kg/sq.cm
Solenoid supply voltage	27 V $\pm$ 10%
Current at 27 V and 20°C	1.2 A, max.
Solenoid operating time	0.1 sec

P r i n c i p l e o f o p e r a t i o n (Figs 304 and 305). With the solenoid switched off, slide valve 8 is forced to the upper position by spring 1, thus connecting union chamber TO UNIT (K AIPEPATY) with union chamber RETURN TO RESERVOIR (CJIB B EAK). When the solenoid is switched on, the slide valve is moved by the rod to the lower position to connect union chamber FROM PUMP (OT HACOCA) with union chamber TO UNIT.

HAND HYDRAULIC PUMP HP-01

Basic Specifications

Diameter of stage 1	30 mm
Diameter of stage 2	17 mm
Piston stroke	25 mm
Maximum operating pressure	150 kg/sq.cm
Pump output for 10 operating strokes, with pumping rate amounting to one stroke per sec:	
at pressure of 35 kg/sq.cm	at least 300 cu.cm
at pressure of 150 kg/sq.cm	at least 10 cu.cm

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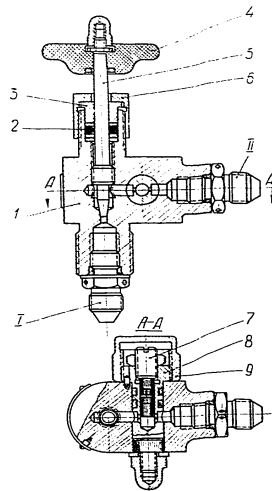


FIG. 303. THROTTLE VALVE ΓA-230
 I — union for connection of pipeline to hydraulic system; II — union for connection of pipeline to windshield wiper;
 1 — housing; 2 — rubber ring; 3 — bush;
 4 — handwheel; 5 — needle; 6 — nut;
 7 — limiter; 8 — liner; 9 — cap.

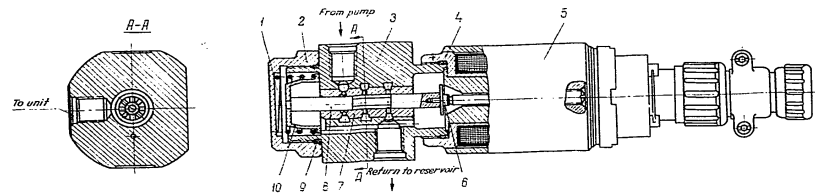


FIG. 304. SOLENOID-CONTROLLED VALVE ΓA-192
 1 — spring; 2 — nut; 3 — housing; 4 and 9 — sealing rings; 5 — solenoid; 6 — stop; 7 — liner; 8 — slide valve; 10 — support.

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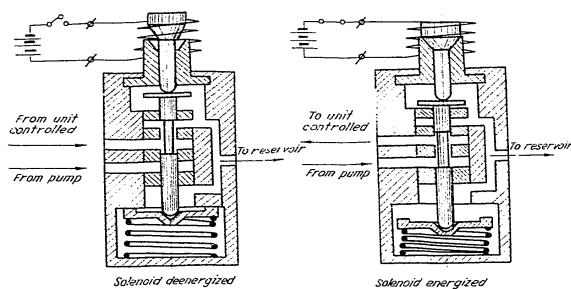


FIG. 305. SCHEMATIC DIAGRAM OF SOLENOID-CONTROLLED VALVE 1A-192.

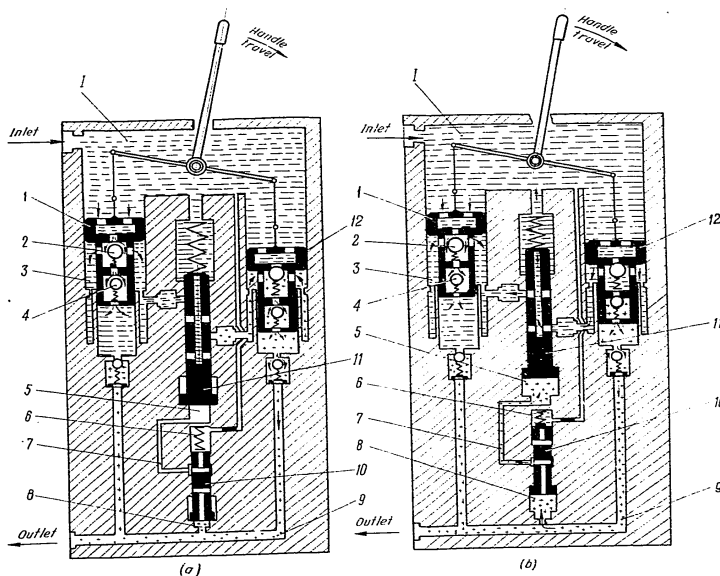


FIG. 306. HAND PUMP HP-01

1 - suction chamber; (a) - hydraulic pump operation at first stage, with counter pressure measuring 45 to 55 kg/sq.cm; (b) - hydraulic pump operation at second stage, with counter pressure exceeding 45 to 55 kg/sq.cm; 1 - left piston; 2 - ball valve; 3 - delivery line; 4 - ball valve; 5 - chamber below slide valve; 6 - spring; 7 - passage; 8 - chamber; 9 - delivery line passage; 10 and 11 - slide valves; 12 - right piston.

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Operation of stage 1 (Fig.306). When the handle is moved to the right, left-hand piston 1 moves upward; both ball valves 2 and 4 open due to rarefaction, thereby allowing the chamber under the piston to be filled with fluid. Meanwhile, right-hand piston 12 moves downward, valve 2 being closed. The fluid displaced by the big piston opens valve 4 and enters passage 9 together with the fluid displaced by the small piston. On entering passage 9, fluid exerts pressure on slide valve 10. The slide valve does not reach the extreme upper position, however, since the pressure does not exceed 55 kg/sq.cm.

With the handle turned to the left, the pistons move in reverse directions: piston 12 draws in fluid and piston 1 operates for fluid delivery.

Operation of stage 2. To reduce effort applied to the handle when delivering hydraulic fluid at a pressure exceeding 55 kg/sq.cm, the pump is furnished with a device by-passing the fluid supplied by the big piston.

The device operates in the following manner. Fluid supplied into passage 9 enters chamber 8 to bring pressure to bear on slide valve 10 and compress spring 6, thus shifting the slide valve to the extreme upper position. This done, the fluid flows via a drilled passage in this slide valve and passage 7 into chamber 5 to lift slide valve 11, which affords communication between chambers 3 under the big pistons and suction chamber I. As a result, hydraulic fluid delivery is performed by the small pistons only, which involves less effort on the handle.

SOLENOID-CONTROLLED VALVE IA-185

To control opening and closing the cargo compartment door panels and loading ramps, two solenoid-controlled valves IA-185 are provided in the system.

Basic Specifications

Working pressure	155 kg/sq.cm
Solenoid operating duty	continuous
Solenoid supply voltage	27 V
Current drained by solenoid	0.9 A

After operation of the respective unit, the solenoids may be de-energized; the valve will remain in the position in which it has been set by the solenoids.

Principle of operation (Figs 307 and 308). When the right-hand solenoid is switched on (position A), armature 25 is attracted to stop 31 and forces ball valve 29 against seat 32, thereby cutting hydraulic fluid flowing from union I off the right-hand piston and directing it into the left-hand piston cylinder chamber. Due to the pressure exerted on left-hand piston 5, the slide valve moves to the extreme right-hand position. In this position union I is connected with union II, whereas union III is connected with union IV.

With the right-hand solenoid dead and the left-hand solenoid energized (position B), the valve ball cuts hydraulic fluid flowing from union I off the left-hand piston and directs it into the chamber of the right-hand piston cylinder. As a result of pressure exerted by hydraulic fluid on the right-hand piston, the slide valve moves to the extreme left-hand position. In this position union I is connected to union III, union II being connected to union IV.

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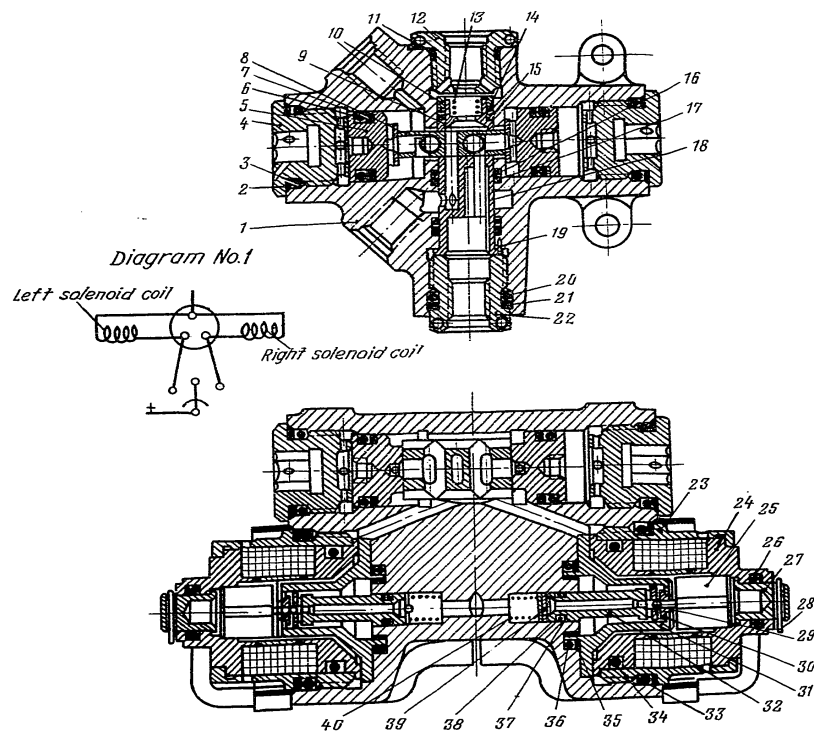


FIG. 307. SOLENOID-CONTROLLED VALVE PA-185

1 - housing; 2 - leather washer; 3, 6, 11, 14, 16, 20, 26, 33, 34, 36, and 38 - rubber sealing rings; 4 - plug;
 5 - piston; 7, 15, 17, 21, 35, and 37 - leather rings; 8 - slide valve; 9 - bush; 10 - ring; 12 - union; 13 -
 spring; 18 - support; 19 - retainer; 22 - union; 23 - solenoid casing; 24 - solenoid coil; 25 - armature;
 27 - plug; 28 - locking ring; 29 - ball; 30 - spacer; 31 - stop; 32 - seat; 33 - filtering element; 40 -
 spring.

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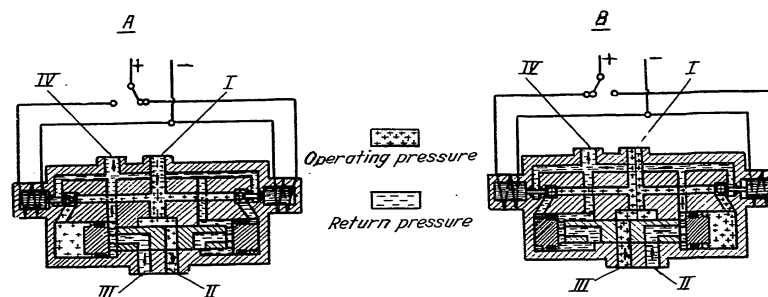


FIG. 308. SCHEMATIC DIAGRAM OF SOLENOID-CONTROLLED VALVE FA-185
I - union for connection of delivery line; II and III - unions for connection of pipeline running from cylinder; IV - union for connection of return line.

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CONTROL OF SLING SYSTEM SWIVEL LOCK

The swivel lock hydraulic control system incorporates hydraulic cylinder 1 (Fig.309), hydraulic valve 3 (IA-2IM/9), and valve 2 for manual release of cargo.

Principle of operation. When the solenoid of hydraulic valve 3 (Fig.309, diagram I) is energized, the valve slide member moves to the right, and hydraulic fluid from the pump flows via hydraulic valve 3 into the upper chamber of the cylinder to cause retraction of rod 1 and release of the swivel lock.

When the hydraulic valve solenoid is switched over (see diagram II), the slide valve travels to the left, hydraulic fluid from the pump flows via hydraulic valve 3 and hand-operated valve 2 into the lower chamber of the cylinder, thereby causing extension of rod 1 and closing the swivel lock.

If the hydraulic system fails to function properly in case it is necessary to perform emergency jettisoning of the cargo, the handle of valve 2 is set in the extreme lower position (see diagram III). This done, the handle of the swivel lock is shifted downward, thus causing hydraulic fluid to be displaced from cylinder 1 and directed to the return line via the hand-operated valve unions (by-passing solenoid-controlled hydraulic valve 3).

SWIVEL LOCK HYDRAULIC CYLINDER

The cylinder is designed for opening and closing the sling system swivel lock. A ball lock incorporated in the cylinder safeguards the swivel lock against inadvertent release when there is no pressure in the hydraulic system.

The hydraulic cylinder (Fig.310) consists of cylinder 1, piston 2, spring 3, floating holder 4, balls 5, sleeve 6, rod 7, eye bolt 8, and other components.

Principle of operation. When fluid is fed under pressure into union II, floating holder 4 compresses spring 3 and brings pressure to bear on piston 2; as a result, balls 5 come out of the groove and release the rod, which moves downward. In case fluid is supplied under pressure into union I, piston 2 with rod 7 goes all the way upward, balls 5 engaging the rod grooves.

In Fig.310 piston 2 and rod 7 are shown in the extreme upper position. The chamfer of floating holder 4 forces balls 5 against the surface of the groove in rod 7, which is thus held in the upper position.

If the lock is to be released manually (there is no pressure in the hydraulic system), an effort in excess of 50 kg should be applied to eye bolt 8 to force the rod downward; this will cause balls 5 to displace floating holder 4 by compressing spring 3. As a result, the rod along with piston 2 will start moving down.

SLING SYSTEM CARGO MANUAL RELEASE VALVE

The valve consists of bronze housing 3 carrying three unions (Fig.311), steel flat slide 4 provided with a distributing groove and a through hole, cover 5, axle 2, handle 1, and other components. As the valve is employed only for releasing the swivel lock, union III is stopped with a plug (Fig.309).

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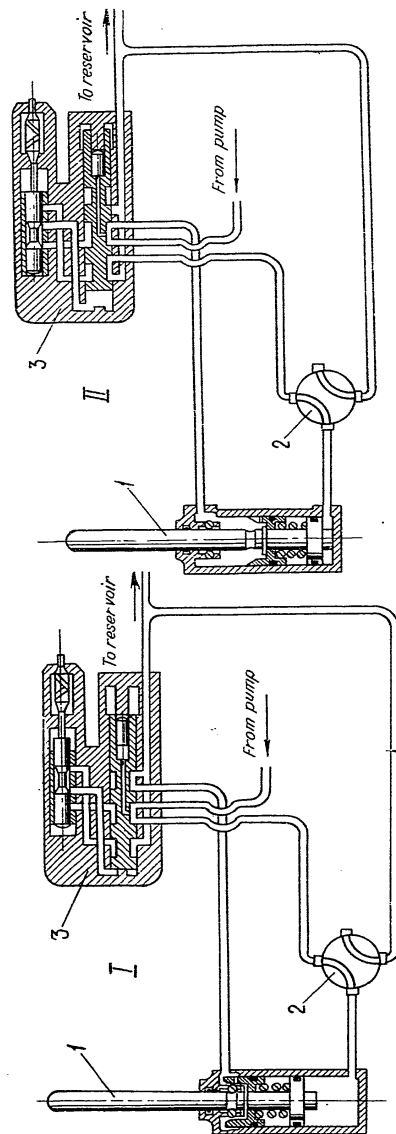
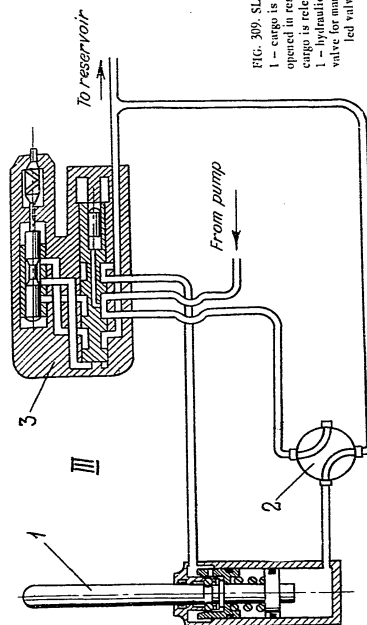


FIG. 309. SLING SYSTEM LOCK CONTROL DIAGRAM
 I - cargo is suspended, lock is closed; II - lock is
 opened in response to pulse supplied to valve 3;
 cargo is released; III - lock is being released manually,
 1 - hydraulic cylinder with rod for lock release; 2 -
 valve for manual release of cargo; 3 - solenoid control
 valve 1/A - 21V/2



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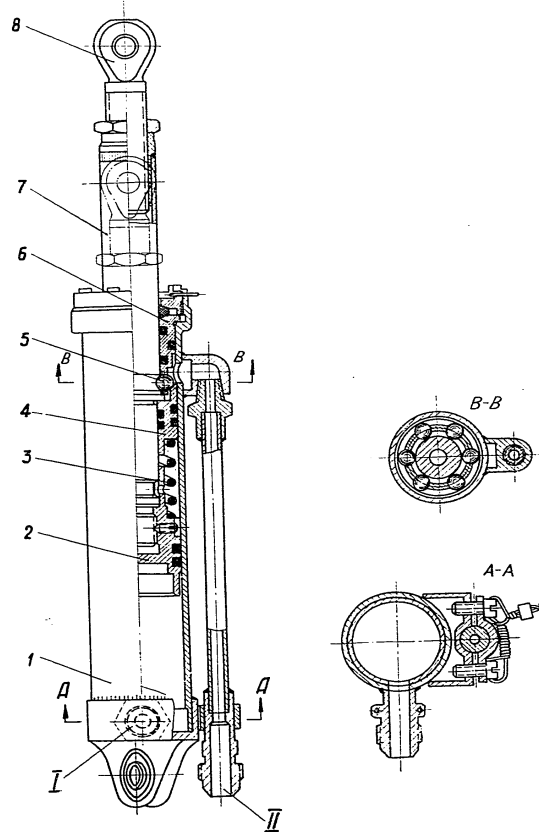


FIG. 310. SLING SYSTEM SWIVEL LOCK HYDRAULIC CYLINDER^⑦
1 - cylinder; 2 - piston; 3 - spring; 4 - floating holder; 5 - ball; 6 - sleeve; 7 - rod; 8 - eye bolt.

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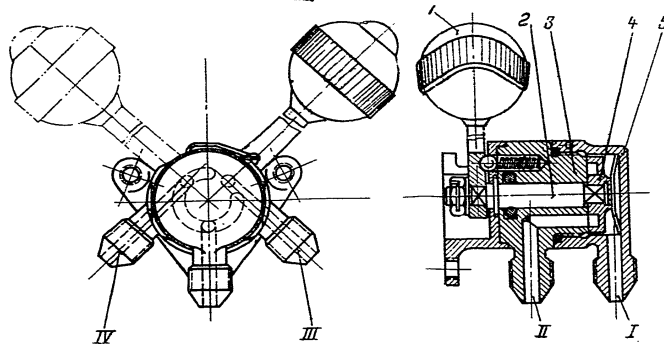


FIG. 311. SLING SYSTEM
CARGO MANUAL RELEASE VALVE
1 - handle; 2 - axle;
3 - housing; 4 - flat
slide; 5 - cover.

HYDRAULIC SYSTEM PIPELINE IDENTIFICATION TABLE		
Pipeline		Paint code
Main hydraulic system	Delivery	
	Return	
	Drainage	
Duplicating hydraulic system	Delivery	
	Return	
	Drainage	
Auxiliary hydraulic system	Suction	
	Delivery	
	Return	
	Drainage	
	Closing	
	Opening	

Symbols

- Black ring (enamel A-12)
- Red ring (enamel A-67P)
- Green ring (enamel A-7)
- Brown ring (enamel A-8)
- Silvery ring (enamel A3-8MX1171315-45)

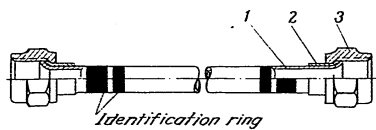


FIG. 312. STANDARD PIPELINE (20)
1 - pipe; 2 - nipple; 3 - union nut.

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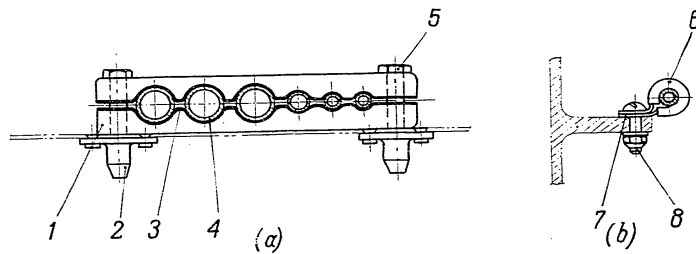


FIG. 313. PIPELINE STANDARD ATTACHMENT FITTINGS
(a) - block fitting; (b) clamping collar fitting; 1 - block; 2 - self-locking nut; 3 - rubber gasket; 4 - hydraulic system pipe; 5 - bolt; 6 - rubber holder; 7 - clamping collar; 8 - bolt with nut.

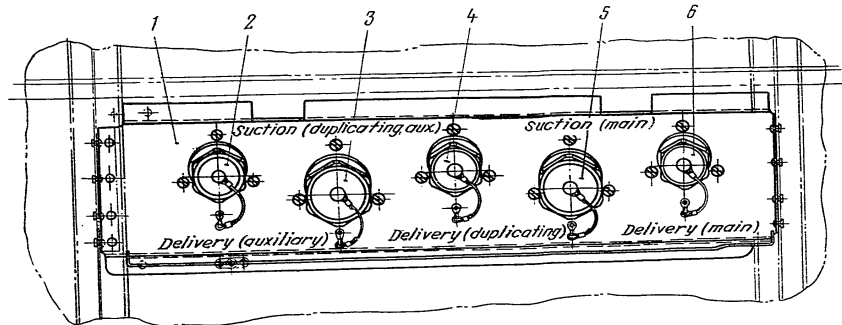


FIG. 314. HYDRAULIC GROUND SUPPLY PANEL
1 - panel; 2 - auxiliary system delivery valve; 3 - duplicating and auxiliary system suction valve; 4 - Duplicating system delivery valve; 5 - main system suction valve; 6 - main system delivery valve.

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⑧ When handle 1 (Fig. 311) is turned to the extreme right-hand position for cargo release, flat slide 4 will likewise be turned. With the valve in this position, fluid flows under pressure from union I to union III, whereas from union IV communicating with the lower chamber of the swivel lock actuating cylinder fluid is directed into the return line via union II. When handle I is set in the initial position, fluid will flow from union I to union IV, whereas union III will be connected to union II, which will cause fluid to pass into the return line.

PIPELINES

The hydraulic system pipelines are run with pipes manufactured from stainless steel IX18H9T and aluminum alloy AMT-M. A standard pipeline is illustrated in Fig. 312. All pipelines of the main and duplicating systems supplying fluid into the hydraulic boosters are laid in the gear box compartment whereas the pipelines of the auxiliary system are led over the fuselage ceiling.

The pipelines are attached to the helicopter framework, gear box frame tubes, and hydraulic panels by means of special duralumin blocks 1 lined with rubber 3, and standard clamping collars 7 with rubber holders 6 (Fig. 313).

Prior to installation on the helicopter, all pipelines are subjected to tests for strength at a fluid pressure of 250 kg/sq.cm and are painted gray. All pipelines have identification rings made in coloured enamel.

The pipeline identification table is arranged on the inside of the left-hand hinged cover of the gear box compartment cowl.

HYDRAULIC GROUND SUPPLY PANEL

The helicopter panel for hydraulic fluid supply on the ground (Ref.No.1, Fig. 314) is arranged between frames Nos 16 and 17 on the fuselage port side; it is fitted with an easy-detachable cover. The panel duralumin stamping constitutes a component of the fuselage structure and carries five valves; valves 2, 4, and 6 are incorporated in the delivery lines, and valves 3 and 5, in the suction lines. These valves serve for connection of the ground hydraulic unit and ensure normal operation of the main, duplicating, and auxiliary systems on the ground. When the auxiliary system is used, the suction hose of the ground hydraulic unit is connected to suction valve 3 incorporated in the duplicating system.

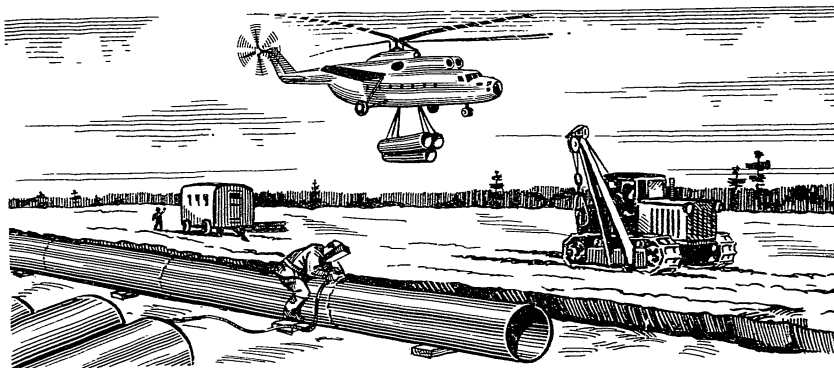
When fitted in place, the hose tips, contained in the ground hydraulic unit set, press off the valves of the hydraulic panel, thereby causing hydraulic fluid to be drawn from the reservoir with subsequent fluid delivery into the system under operating pressure. To provide complete sealing of the hydraulic panel unions, the latter are stopped with additional plugs (after the ground hydraulic unit has been used), furnished with rubber seals.

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Chapter XI

HELICOPTER PNEUMATIC SYSTEM

The helicopter pneumatic system (Fig.315) serves for supplying compressed air to the main landing gear brakes, engine compressor blow-off band control mechanism, and cabin heating and ventilation system shutter control mechanisms.

Air compressed to 50 kg/sq.cm is kept in bottles 20 and 24 formed by the cavities in the main landing gear shock strut upper portions. Pressure in the bottles is boosted by AK-50T compressor 7 mounted on the port side engine.

The bottles are charged with compressed air on the ground through ground charging union 18 located on the pneumatic system ground supply panel. Union 9 serves for charging the four accumulators of the hydraulic assembly with nitrogen. Shown in Fig.316 is the pneumatic system ground supply panel.

Mounted on the pipeline running from charging union 18 (see Fig.315) are straight-flow air cleaner 17 and non-return valve 16. The pipeline led from compressor 7 mounts type 9900 filtering sediment bowl 12, non-return valve 11, and type AI-50 automatic pressure regulator 15 which serves also the line running from charging union 18 when the air bottles are charged on the ground.

AUTOMATIC PRESSURE REGULATOR AI-50

The purpose of the pressure regulator is to automatically change the compressor from working duty over to idle running and vice versa (for filling the compressed air bottles). The compressor is shifted from working duty to idle running at a pressure of 50^{+4} kg/sq.cm, and from idle running to working duty at a pressure not below 40 kg/sq.cm in the compressed air bottles.

Shown in Fig.317 is the operation diagram of the AI-50 pressure regulator.

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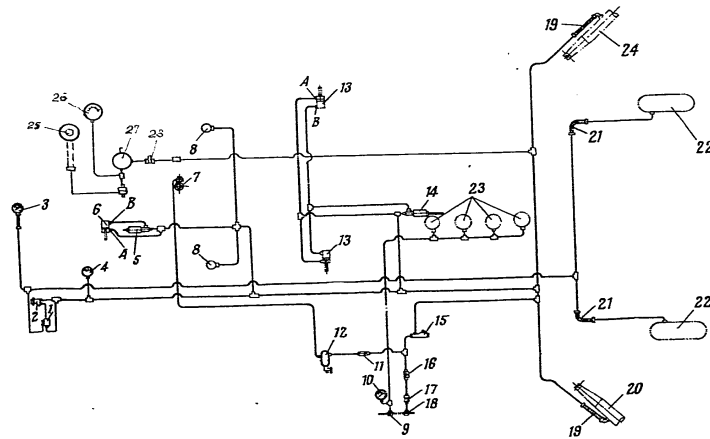


FIG. 315. SCHEMATIC DIAGRAM OF HELICOPTER PNEUMATIC SYSTEM

1 - brake control valve (debooster) VII-03/1; 2 - pressure reducing valve ПУ-7; 3 - pressure gauge MB-60M; 4 - pressure gauge MB-100M; 5 and 14 - electrically operated pneumatic valves; 6 and 13 - tee-piece shutter actuating cylinders of cabin heating and ventilation system; 7 - compressor AK-50T; 8 - automatic solenoid-controlled air valves; 9 - hydraulic accumulator ground charging union; 10 - pressure gauge MB-250M; 11 - non-return valve; 12 - filtering sediment bowl; 15 - automatic pressure regulator АД-50; 16 - non-return valve; 17 - air cleaner; 18 - air bottle ground charging union; 19 and 21 - flexible hoses; 20 and 24 - air bottles; 22 - main landing gear wheels; 23 - hydraulic accumulators; 25, 26, 27, 28 see fig. 59, Book II (Helicopter argument).

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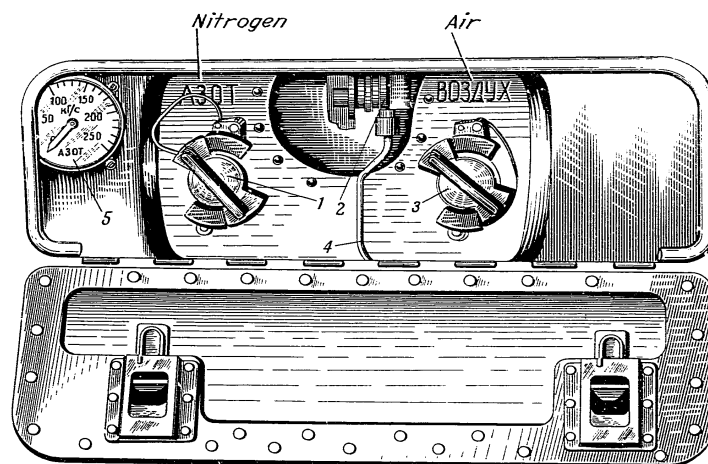


FIG. 316. HELICOPTER PNEUMATIC SYSTEM GROUND SUPPLY PANEL (EXTERNAL VIEW WITH HATCH COVER HINGED OFF)

1 - union for charging hydraulic accumulators with nitrogen; 2 - cock for draining condensate from filtering sediment bowl; 3 - union for charging pneumatic system with air; 4 - pipe for draining condensate from filtering sediment bowl; 5 - pressure gauge for checking pressure when charging hydraulic accumulators with nitrogen.

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As the pressure in the bottle drops to 40 - 50 kg/sq.cm, the non-return valve is forced to the left and air begins to flow from the compressor into the bottle through the air cleaner. When the pressure in the bottle reaches a value of 50^{+4} kg/sq.cm, the piston is caused by this pressure to move to the left; at the same time, the lever forces the needle upward thus affording communication between the compressor delivery line and the atmosphere.

WHEEL BRAKING SYSTEM

The wheel braking system is fed with compressed air from air bottles 20 and 24 (see Fig.315) of the shock struts. From these bottles air is led simultaneously to pressure reducing valve 2 and brake control valve 1. After the air pressure has been reduced to the required value, air is directed from the brake control valve into the wheel braking chambers.

The wheel braking system is controlled by means of an actuator located on the pilot's (L.H.) control stick. The actuator is connected with the bell crank through a cable enclosed in the Bowden jacket. As the actuator is depressed, the bell crank displaces the pusher of valve IV-7. Depending on the amount of pusher displacement, the pressure of the air leaving the valve is reduced to 4.5 kg/sq.cm to be applied to the brake control valve signal pressure cavity. As a result, the brake control valve (debooster) operates to direct the compressed air from the bottles into the wheel braking chambers, reducing the air pressure in so doing to 13.5 kg/sq.cm.

The air pressure in the bottle is checked with type MB-100M pressure gauge mounted on the flight engineer's panel, and that in the braking chambers, with type MB-50M pressure gauge located on the pilots' instrument panel.

The IV-7 pressure reducing valve (Fig.318) is a control unit used in the wheel braking system for feeding air at a reduced pressure into the signal pressure cavity of the VI-03/I brake control valve. In its turn, the brake control valve reduces the pressure and causes the air to flow from the bottles into the wheel braking chambers. The degree to which the air pressure is reduced depends on the amount of valve pusher displacement.

Air from the pneumatic system is applied at a pressure of 50 kg/sq.cm to union A (see Fig.138), but is not admitted to the brake control valve until the pilot depresses the actuator.

The moment the brake control actuator is depressed, air is directed through union B and a pipeline into the signal pressure cavity of the brake control valve (debooster).

Fig.318 shows the valve in the BRAKE RELEASED (PACTOPMOKEHO) position. The cavity of union B is connected with the atmosphere through open smaller outlet valve 5. Air from the compressed air bottle cannot enter the cavity since the way is blocked by larger inlet valve 7 and smaller inlet valve 8.

Pusher 13 being depressed, pressure reducing spring 3 will cause piston 10 to move downward. Since the piston seat rests against larger outlet valve 4, the latter will be displaced to come up against smaller outlet valve 5, thus disconnecting middle cavity 9 from the atmosphere. As the pusher moves further downward, smaller inlet valve 8 and larger inlet valve 7 get opened. As a result, compressed air from the bottles flows through the lower and middle cavities into the brake control valve.

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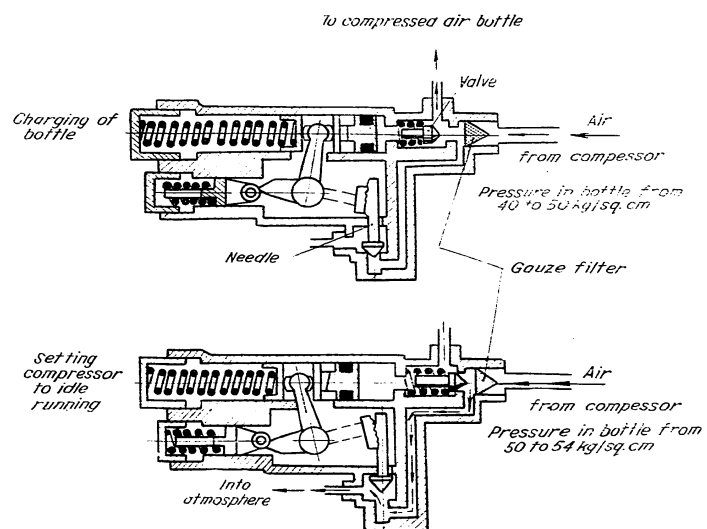


FIG. 317. DIAGRAM OF OPERATION OF VI 50 AUTOMATIC PRESSURE REGULATOR.

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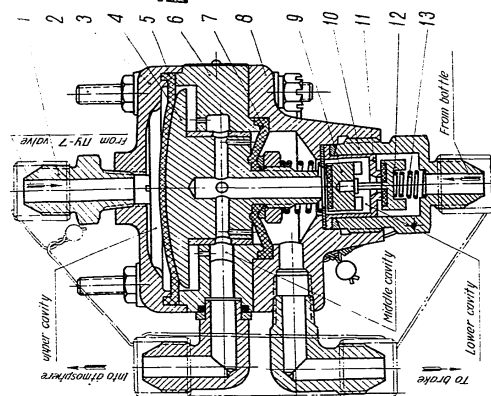


FIG. 319. BRAKE CONTROL VALVE (DEROOSTER)
VII-03/1

1 - union; 2 - bolt; 3 - cover; 4 - piston; 5 and 7 - diaphragms; 6 - ring; 8 - body; 9 - outlet valve; 10 - union; 11 - guide; 12 - inlet valve; 13 - spring.

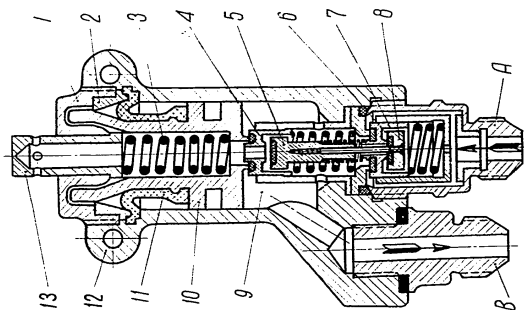


FIG. 318. PRESSURE REDUCING VALVE
III-7

1 - nut; 2 - ring; 3 - pressure reducing spring; 4 - larger outlet valve; 5 - smaller outlet valve; 6 - lower cavity; 7 - larger inlet valve; 8 - smaller inlet valve; 9 - middle cavity; 10 - piston; 11 - boot-type diaphragm; 12 - valve body; 13 - pusher.

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As the load is removed from the pusher, the piston will go upward and the piston seat will move away from the larger outlet valve thus connecting the middle cavity and, hence, the signal pressure cavity of the brake control valve with the atmosphere; this done, the wheel brakes will get released.

The VII-03/I brake control valve (debooster) is designed for by-passing the compressed air from the bottles into the wheel braking chambers and reducing the air pressure to 13.5 kg/sq.cm.

The brake control valve is actuated by the signal pressure applied to it by valve IIV-7.

The debooster unit consists of a stepped piston and two rubber diaphragms (see Fig.319). These parts divide the debooster valve into three parts: upper cavity receiving signal pressure sent by the IIV-7 valve, middle cavity which gets connected with the atmosphere, and lower (reduced pressure) cavity communicating with the brakes.

The pressure reduction is accomplished due to the difference between the areas of the piston applied to one side of which is the signal pressure from the IIV-7 valve, and to the other, the reduced pressure in the braking chambers. The pressure differential causes the piston to move thus by-passing the air from the bottles into the wheel braking chambers. The pressure in the brakes will increase until the piston is shifted by the two pressures to a state of balance. This being the case, air supply into the wheel brakes will be discontinued.

CONTROL OF ENGINE COMPRESSOR AIR BLOW-OFF SYSTEM

Air blow-off is controlled by the engine automatic control system (see description of the A-25B engine). Compressed air to solenoid-operated valves 8 (Fig.315) mounted on the engine is fed from the compressed air line along pipelines.

TEE-PIECE SHUTTER CONTROL OF CABIN VENTILATION AND HEATING SYSTEM

The shutters of the cabin ventilation and heating system tee-pieces are remotely controlled from the pilots' cabin with the aid of electrically operated pneumatic devices. These include pneumatic actuating cylinders 6 and 13 and electrically operated pneumatic valves 5 and 14 (Fig.315).

With electrically operated valve 14 de-energized, air flows simultaneously into both cavities of cylinder 13, and, due to the difference in the piston areas, causes the rod to be displaced. The rod is connected through a fork with the shutter control mechanism lever; the tee-piece shutters are forced to turn, and the hot air is let out into the atmosphere.

With power out in to the electrically operated valve, cavity B of cylinder 13 is connected with the atmosphere through the side union of valve 14. In this case, the cylinder rod along with the fork and tee-piece shutters will be forced to move in the reverse direction. Hot air will be directed into the air-to-air heat exchangers of the cabin heating system; on passing through the heat exchangers, the air flows out into the atmosphere.

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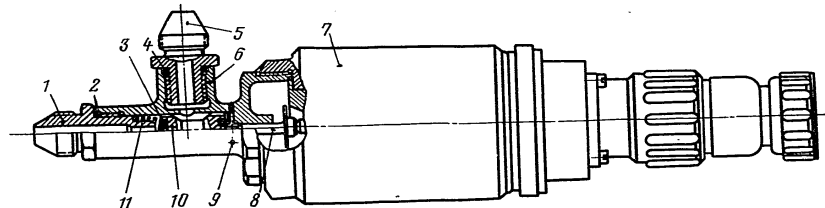


FIG. 320. ELECTRICALLY OPERATED PNEUMATIC VALVE
1 - union; 2 - sealing ring; 3 - rubber; 4 - sealing ring; 5 - union; 6 - valve body; 7 - solenoid 3MK-OM; 8 - pusher;
9 - air release hole; 10 - slide valve; 11 - spring.

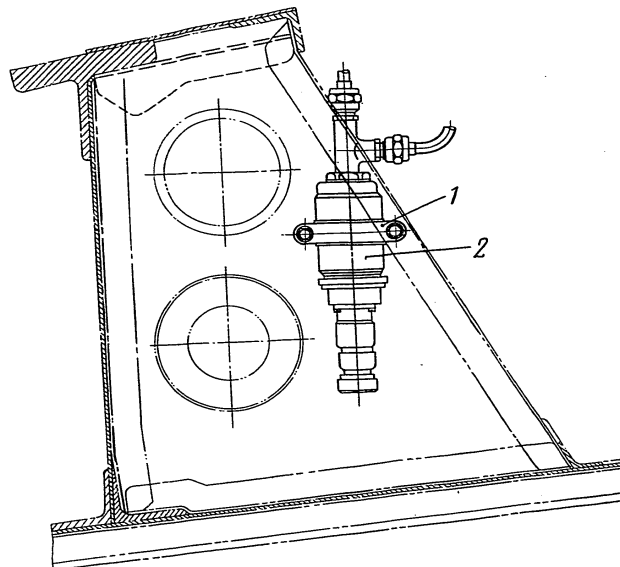


FIG. 321. INSTALLATION OF ELECTRICALLY OPERATED PNEUMATIC VALVE CONTROLLING
HOT AIR PIPELINE SHUTTERS
1 - valve clamping collar; 2 - electrically operated pneumatic valve.

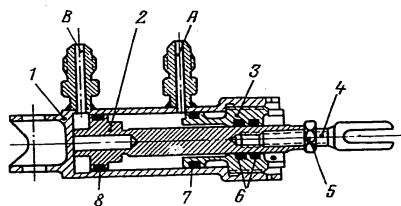


FIG. 322. SHUTTER ACTUATING CYLINDER
1 - cylinder body; 2 - rod-type piston; 3 - nut; 4 - fork; 5 -
locking nut; 6, 7, and 8 - sealing rings; A and B - unions.

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The tee-piece shutters in the cold air pipeline are controlled by pneumatic cylinder 6 and electrically operated pneumatic valve 5. With the valve dead, the shutters are in a position at which the cold air from the cargo compartment is directed into the air-to-air heat exchangers. When the electrically operated pneumatic valve is energized, the shutters move in the opposite direction; the cold air from the atmosphere enters the system via the air intake and is directed through the air-to-air heat exchangers into the heating or ventilation lines of the helicopter cabins and cargo compartment.

Hot air shutter electrically operated pneumatic control valve 14 is mounted in the gear box compartment on the partition secured to frame No.14, whereas like valve 5 is installed on the engine compartment ceiling between frames Nos 2 and 3.

The electrically operated pneumatic valve (see Fig.320) comprises solenoid 7, valve body 6 with unions 1 and 5, and sealing rings 2 and 4. The body houses slide valve 10 with rubber cured in at its faces, pusher 8, and spring 11.

When the valve solenoid is dead, spring 11 and the air pressure applied through union 1 cause the slide valve to press its face against the body seat. Air from union 1 enters union 5 to flow via a pipeline into union B of cylinder 6 (see Fig.315).

With power cut in to the solenoid, pusher 8 (see Fig.320) presses slide valve 10 to the seat of union 1, due to which air flow from the pneumatic line is interrupted, and the line of union 5 gets connected to union B of cylinder 6 (Fig.315) thus communicating with the atmosphere through hole 9 (Fig.320) made in the valve body.

The operating principle of pneumatic valve 14 and cylinders 13 is similar to that just described above. The installation of valve 14 is illustrated in Fig.321.

The shutter actuating cylinder (Fig.322) consists of steel body 1 with two unions A and B welded to it, rod-type piston 2 with sealing ring 8, nut 3 with sealing rings 6 and 7, fork 4, and locking nut 5.

Air into the cylinder is fed through two unions; union A serves to receive the pipeline running from the pneumatic system line, and union B, the pipeline led from union 5 of the electrically operated pneumatic valve (see Fig.320). The installation of the cylinder on the hot air line tee-piece is illustrated in Fig.99.

PIPELINES

The pneumatic system lines employ pipes made from AM1M alloy and 1X18H9T steel. Steel pipes are used on the charging line led from the compressor and ground charging union to the automatic pressure regulator, as well as on the line supplying compressed air to the wheel brakes.

The pipelines are run through the fuselage and the gear box and cowl compartments. Wherever the pipelines are connected to the compressed air bottles, landing gear struts, and wheel brakes, use is made of flexible hoses.

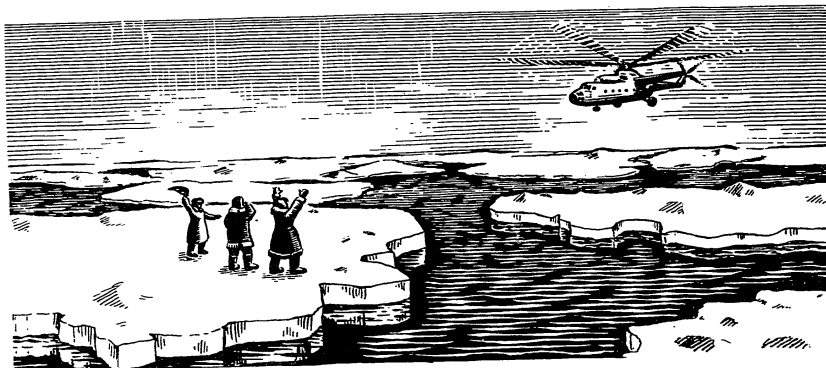
The pneumatic system pipelines are painted black and marked with coloured rings.

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Chapter XII

DE-ICING SYSTEM[®]

The helicopter de-icing system serves to ensure normal flying under ice formation conditions. To this end, the main and tail rotor blades, the engine air intake rings, and the glass panels of the pilots' and navigator's cabins are provided with special de-icing appliances.

The operation of all the helicopter-carried de-icing equipment is based on an electrical heating principle. The main and tail rotor blades are fitted with de-icers of cyclic operation mode, whereas de-icers mounted on the engine air intakes and cabin glass panels employ a continuous mode of operation.

The helicopter de-icing system is supplied with 208-V, 400-c.p.s. three-phase alternating current produced by two generators, type CIC-90/360, operating in parallel and rated for 90 KVA each. Fig.323 illustrates the generator installation.

The generators are secured to main gear box 10 with studs 4 and nuts 5. Cophasal operation of the two generators is achieved by turning flange 2 of the generator stator relative to the main gear box flange and fixing it in the required position. Mounted on the main gear box flange is special intermediate flange 1 which is provided with a projection along the contour. The holes drilled in the projection serve to receive retaining shaft 3. To permit turning the generator stator through some angle in adjusting the two machines for cophasal operation, the attachment holes for studs 4 made in flange 2 are oval in shape. Retaining shaft 3 is not inserted in place until after final adjustment of the generators for cophasal operation which is performed with nuts 5 being tightened up.

The generator rotor is driven by the main gear box drive shaft connected with generator drive shaft 8 through thrust coupling 9. The generator rotor RPM are equal to those of the engine free turbine.

The generators employ a forced air cooling system. Cooling air is supplied from the helicopter fan through connection 7. The generators are provided with voltage adjustment and overload protection systems.

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As the load is removed from the pusher, the piston will go upward and the piston seat will move away from the larger outlet valve thus connecting the middle cavity and, hence, the signal pressure cavity of the brake control valve with the atmosphere; this done, the wheel brakes will get released.

The YH-08/I brake control valve (debooster) is designed for by-passing the compressed air from the bottles into the wheel braking chambers and reducing the air pressure to 13.5 kg/sq.cm.

The brake control valve is actuated by the signal pressure applied to it by valve IIV-7.

The debooster unit consists of a stepped piston and two rubber diaphragms (see Fig.319). These parts divide the debooster valve into three parts: upper cavity receiving signal pressure sent by the IIV-7 valve, middle cavity which gets connected with the atmosphere, and lower (reduced pressure) cavity communicating with the brakes.

The pressure reduction is accomplished due to the difference between the areas of the piston applied to one side of which is the signal pressure from the IIV-7 valve, and to the other, the reduced pressure in the braking chambers. The pressure differential causes the piston to move thus by-passing the air from the bottles into the wheel braking chambers. The pressure in the brakes will increase until the piston is shifted by the two pressures to a state of balance. This being the case, air supply into the wheel brakes will be discontinued.

CONTROL OF ENGINE COMPRESSOR

AIR BLOW-OFF SYSTEM

Air blow-off is controlled by the engine automatic control system (see description of the A-25B engine). Compressed air to solenoid-operated valves 8 (Fig.315) mounted on the engine is fed from the compressed air line along pipelines.

TEE-PIECE SHUTTER CONTROL OF CABIN VENTILATION AND HEATING SYSTEM

The shutters of the cabin ventilation and heating system tee-pieces are remotely controlled from the pilots' cabin with the aid of electrically operated pneumatic devices. These include pneumatic actuating cylinders 6 and 13 and electrically operated pneumatic valves 5 and 14 (Fig.315).

With electrically operated valve 14 de-energized, air flows simultaneously into both cavities of cylinder 13, and, due to the difference in the piston areas, causes the rod to be displaced. The rod is connected through a fork with the shutter control mechanism lever; the tee-piece shutters are forced to turn, and the hot air is let out into the atmosphere.

With power cut in to the electrically operated valve, cavity B of cylinder 13 is connected with the atmosphere through the side union of valve 14. In this case, the cylinder rod along with the fork and tee-piece shutters will be forced to move in the reverse direction. Hot air will be directed into the air-to-air heat exchangers of the cabin heating system; on passing through the heat exchangers, the air flows out into the atmosphere.

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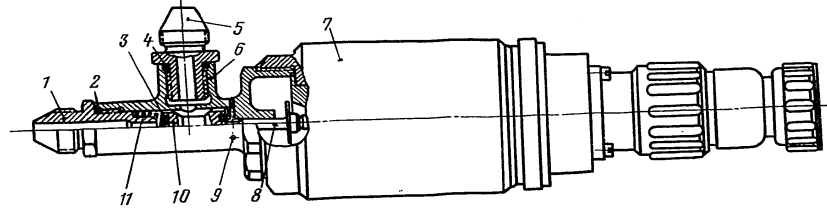


FIG. 320. ELECTRICALLY OPERATED PNEUMATIC VALVE
1 - union; 2 - sealing ring; 3 - rubber; 4 - sealing ring; 5 - union; 6 - valve body; 7 - solenoid 3MK-OM; 8 - pusher;
9 - air release hole; 10 - slide valve; 11 - spring.

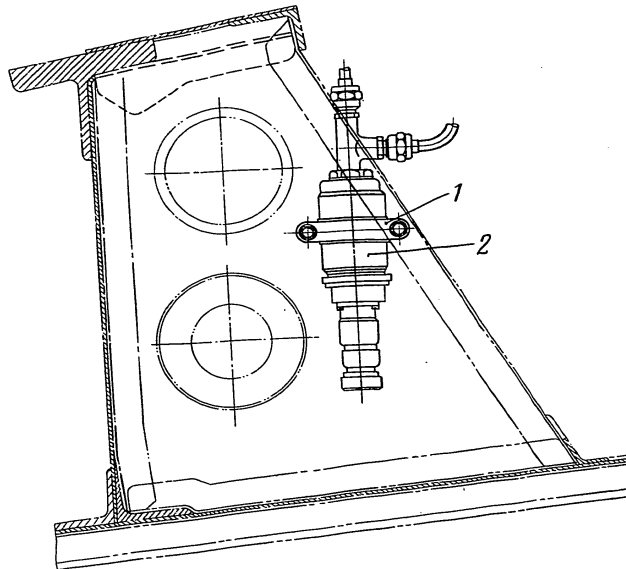


FIG. 321. INSTALLATION OF ELECTRICALLY OPERATED PNEUMATIC VALVE CONTROLLING
HOT AIR PIPELINE SHUTTERS
1 - valve clamping collar; 2 - electrically operated pneumatic valve.

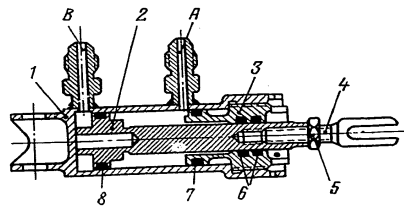


FIG. 322. SHUTTER ACTUATING CYLINDER
1 - cylinder body; 2 - rod-type piston; 3 - nut; 4 - fork; 5 -
locking nut; 6, 7, and 8 - sealing rings; A and B - unions.

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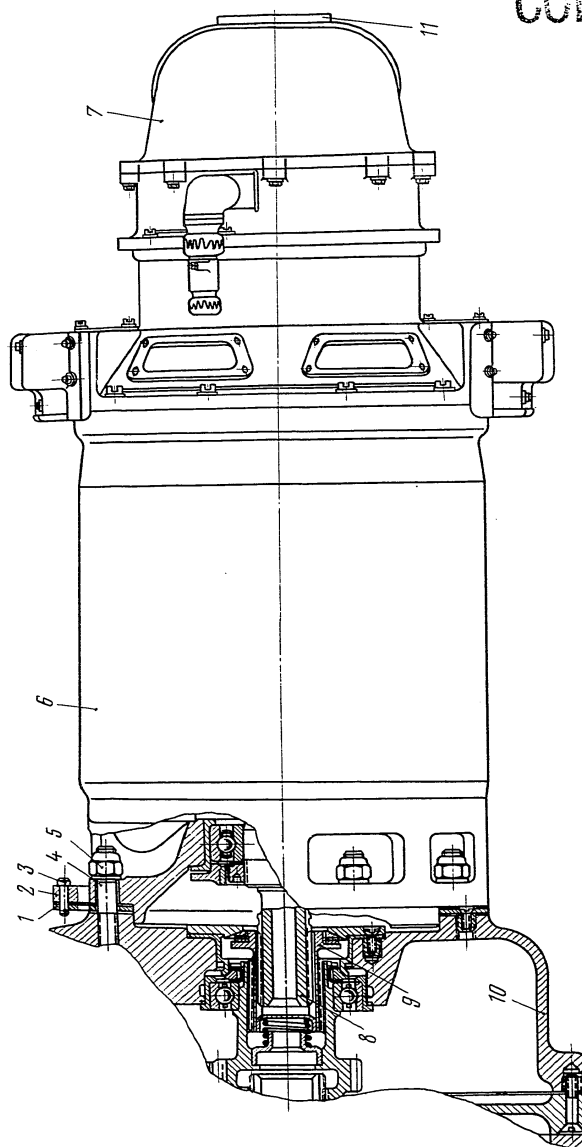


FIG.323. INSTALLATION OF GENERATOR
 1 - intermediate flange; 2 - generator body flange; 3 - retaining shaft; 4 - nut; 5 - stud; 6 - generator CTC-80/360; 7 - cooling air connection; 8 - generator drive shaft; 9 - thrust coupling; 10 - main gear box; 11 - cover of inspection hole used for checking alignment of notches on stator and rotor.

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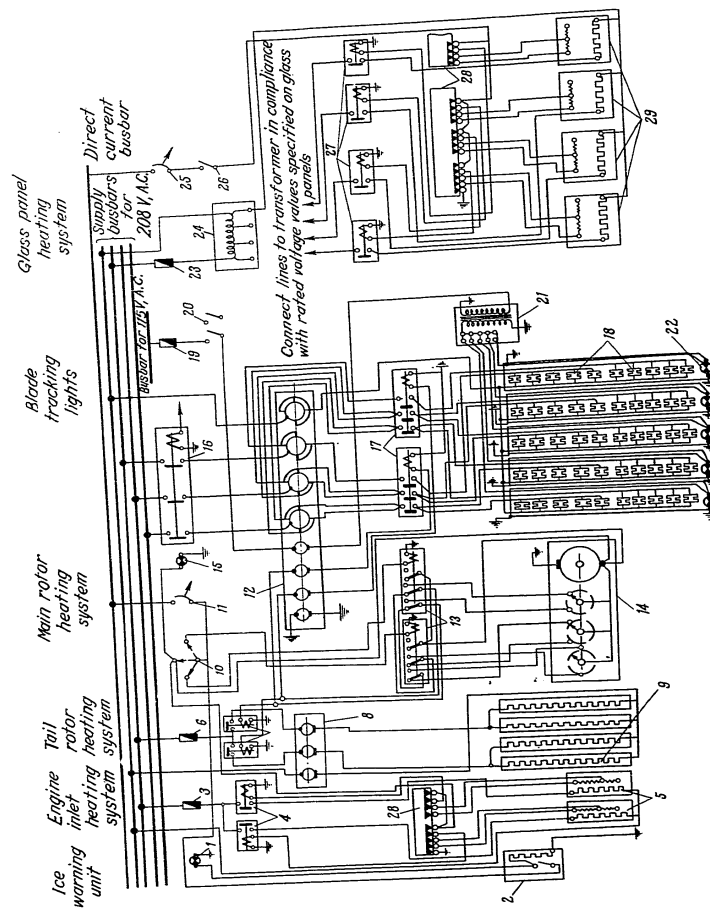


FIG. 24. SCHEMATIC CIRCUIT DIAGRAM OF HELICOPTER DE-ICING SYSTEM

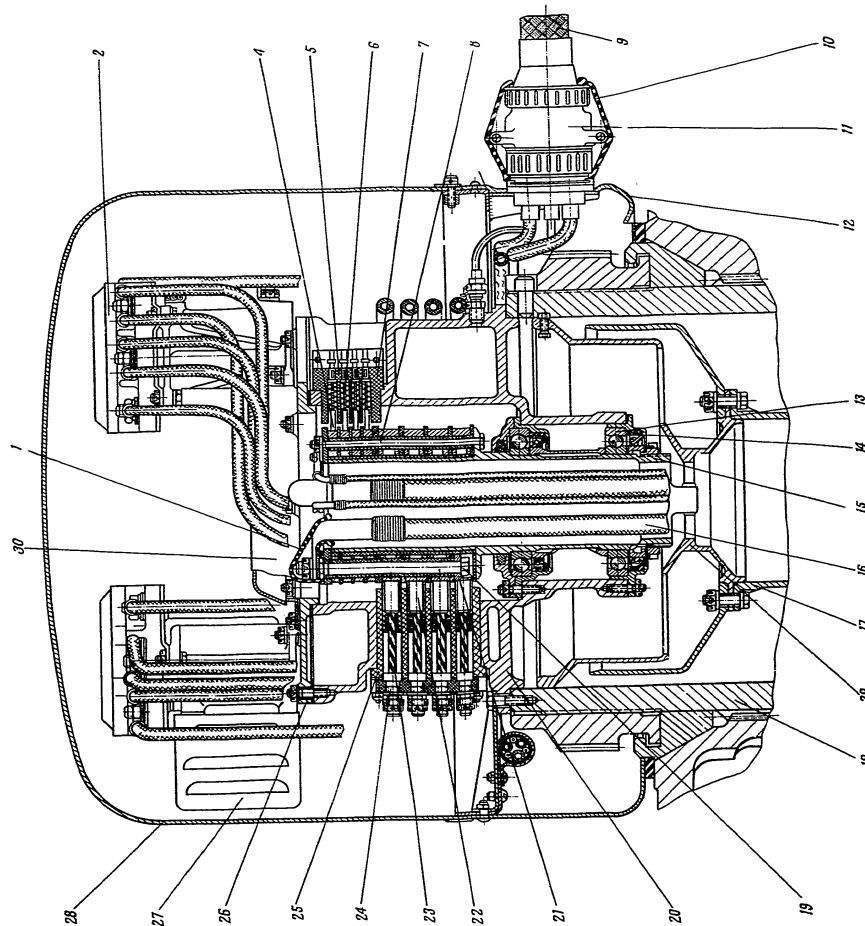
FIG. 24.1. SCHEMATIC CIRCUIT DIAGRAM OF HELICOPTER SYSTEM

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FIG. 325. MAIN ROTOR SLIP RING ASSEMBLY

- 1 - protective rubber cover;
2 - protective cover; 3 - contact
for 110V; 4 - fluid supply
line; 5 - plug connector;
6 - brush; 7 - brush block;
8 - coupling bolt; 9 - bunched
conductor turning to blade
heaters; 10 - rubber boot;
11 - plug connector; 12 - lower
fairing; 13 - ball bearing;
14 - sealing collar; 15 - com-
mutator shaft; 16 - bunched
conductor; 17 - main gear box
protective casing; 18 - contact
gear; 19 - slip ring assembly
housing; 20 - slip ring; 21 -
brush; 22 - pin; 23 - contact
bolt; 24 - brush block; 25 -
slip ring assembly housing cover;
26 - blade tracking light
transformer; 27 - detachable
fairing; 28 - centering ring
for installation of slip ring
assembly; 29 - cap;
30 - cap.



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Selector switch 10 (Fig.324) serves for switching on both the engine air intake heaters and the main and tail rotor blade cyclic heating control system.

The main rotor heating system is controlled and power to the heaters is applied through slip ring assembly 12.

The slip ring assembly is secured to main gear box shaft 18 (see Fig.325) and comprises a commutator and slip ring assembly housing 20 cast of AL-9 alloy. The housing has a flange, by means of which it is attached to the main gear box shaft, and five recesses for the attachment of the brush blocks. Four brush blocks 25 serve for the installation of the power supply brushes; they are made from AL-4 pressed material and are secured to the slip ring assembly housing with the aid of studs. Each of the brush blocks carries four brushes 22 with springs and contact bolts 24 connected to the brushes through pigtails 23.

The arrangement of the brush blocks with sixteen brushes provides for good contact between the latter and the four slip rings of the commutator (four brushes per each slip ring).

Fifth brush block 7 is made from textolite. It is secured on studs to the brush holder body, being intended to carry four brushes 4 with springs 6 and plug connector 5. These brushes serve to ensure electrical connection with the main rotor blade heater cut-in contactors and to switch on the blade tracking lights.

Mounted in two ball bearings 13 arranged in the lower portion of the slip ring assembly, is commutator shaft 15. During assembly the bearing unit is packed with grease, collars 14 being used to retain it in the bearings while in service.

The slip ring assembly housing along with the brushes is rotated by the main gear box shaft, whereas shaft 15 of the commutator is fixed against rotation by main gear box protective casing 17. The casing is provided with centring ring 29 secured to the flange of the main gear box case.

Fitted onto commutator shaft 15 and interlaid with textolite spacers are eight bronze slip rings 21. Four rings are intended for alternating current supply, the other four rings being used for controlling the de-icer and the blade tracking lights. The entire ring pack is braced up with the aid of coupling bolts 8.

Each slip ring is fitted with contact bolt 19. Secured to these bolts are the wires of bunched conductor 16.

The cover of the slip ring assembly housing carries two three-phase current contactors 2 and blade tracking light transformer unit 27.

Attached to the brush holder body flange is lower fairing 12 secured to which is upper detachable fairing 28; these fairings protect the slip ring assembly against precipitation and dust. The slots made in the bottom of the lower fairing serve for letting in the cooling air.

Fixed to the lower fairing are five plug connectors 11 on which the wires led from contactors 2 are terminated. Bunched conductors 9 running from the plug connectors to the blade heating elements are made up of soft wires enclosed in rubber hoses. The plug connectors are protected against atmospheric moisture by rubber boots 10.

Heating elements 18 of each main rotor blade are divided into two sections (see Fig.324): the root and tip ones with approximately equal resistances. During cyclic operation of the de-icer, the root elements of all the blade heaters and, then, the tip elements are successively switched on.

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The heating elements are arranged over the entire length of the blade on the bottom and top surfaces of the blade leading edge at 11.5% and 14.5% of chord by the root and tip, respectively. The resistance values of the heating elements have been so selected that the specific current power on the heated surface equals 0.97 to 1.68 W/sq.cm.

The intensity of blade surface heating is adjusted by varying specific current loads on the unit of the blade surface and by changing the heater resistance across various portions of the surface with specific current load on the unit of the surface being constant, i.e. by changing the current density per unit of the heating element cross-section.

Apart from the above adjustment of the heat intensity being a function of the degree of blade surface heat emission, provision is made for adjustment of the heat intensity connected with varying ambient temperature conditions. The adjustment of this kind is performed by changing the heating and cooling time periods within one operating cycle.

Timer MKA-3A (Ref.No.14, Fig.324) serves to cut in power to the windings of three-phase current contactors 17 thus providing for the following heater operating cycles:

- cycle I - 20-sec heating, 100-sec cooling
- cycle II - 40-sec heating, 80-sec cooling
- cycle III - 60-sec heating, 60-sec cooling.

The required cycle is selected by means of selector switch 10, mounted on the middle instrument panel in the pilots' cabin, through two relays 13.

As was already mentioned above, blade tracking lights 22 are switched on through the main rotor slip ring assembly. Cut into the electric circuit of these lights is transformer 21.

The tail rotor blade heaters are controlled by three-phase current contactors 7, whose control winding is switched on by the MKA-3A timer. This done, the heaters of two opposite blades are cut in for cyclic operation. The tail rotor blades are electrically connected with contactors 7 through slip ring assembly 8.

The tail rotor slip ring assembly (Fig.326) comprises current collectors 3 and commutator 7 with slip rings 8.

Secured to the tail gear box flange is protective casing 6 attached to which are two current collectors 3 with brushes 2. Each current collector is provided with a plug connector and protective casing 4. To safeguard the slip ring assembly against precipitation, provision is made for ring 9 mounted on the protective casing and diaphragm 10 installed on the commutator. The commutator rotates in the tail rotor slip ring assembly, whereas current collectors 3 are motionless. From commutator 7 the wires are run to the blade heating elements.

The engine air intake rings (Fig.324) are warmed up by heaters 5 which are switched on by contactors 4. Power to the control winding of the contactor is cut in by selector 10 through heater automatic control unit 28. In case of surface overheating, the heater automatic control unit transmitters mounted in the engine air intake rings send a pulse to their parent unit which operates to break the circuit of the control winding of contactors 4 thus switching off the heater.

The glass panels of the pilots' and navigator's cabins are warmed with the aid of film-type heaters 29 which are controlled by switch 26 through heater automatic control unit 28 and contactor 27.

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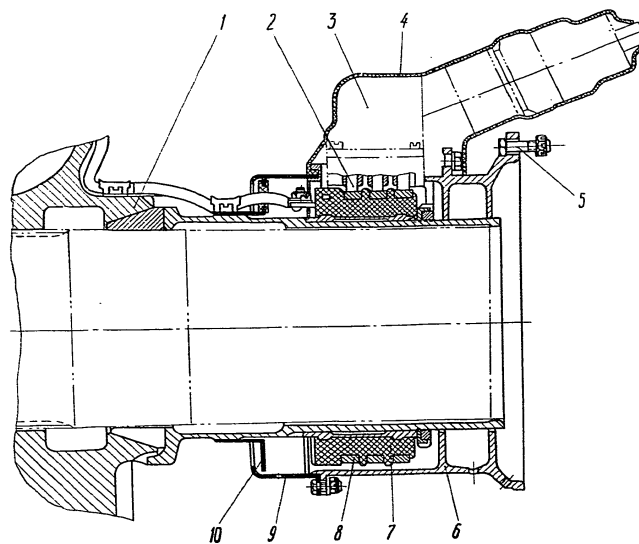


FIG.326. TAIL ROTOR SLIP RING ASSEMBLY

1 - tail rotor hub; 2 - brush; 3 - current collector; 4 - protective casing; 5 - slip ring assembly-to-tail gear box attachment bolt; 6 - protective casing; 7 - commutator; 8 - slip ring; 9 - protective ring; 10 - protective diaphragm.

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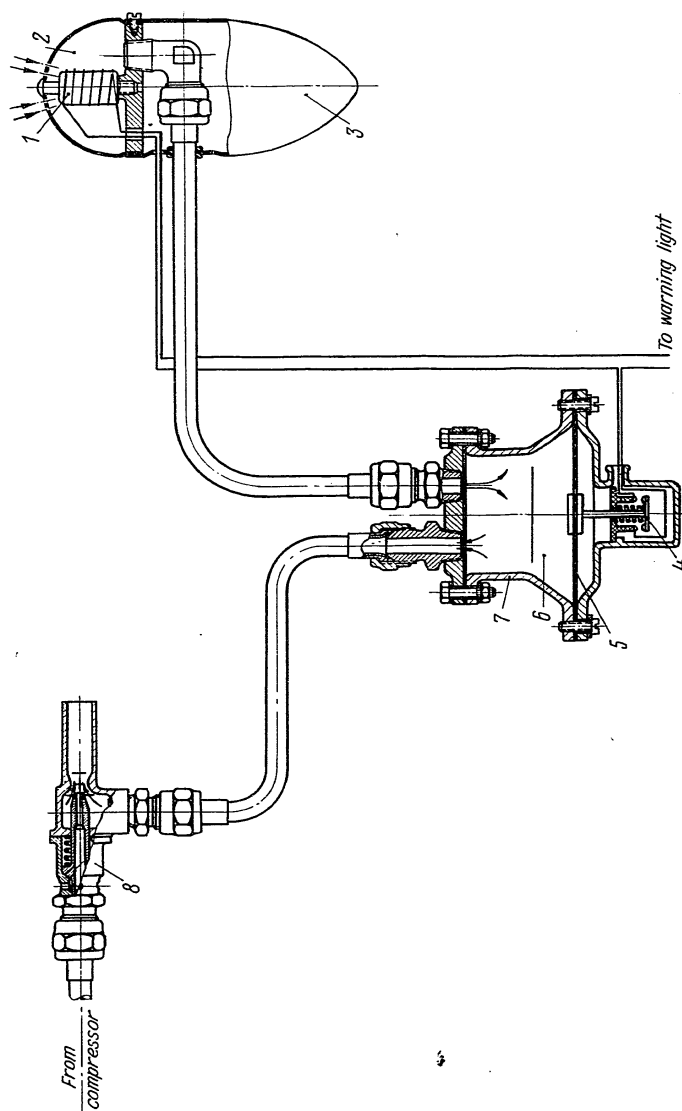


FIG.327. ICE WARNING UNIT SCHEMATIC DIAGRAM
 1 - heating elements; 2 - pressure pick-up chamber; 3 - pressure pick-up; 4 - microswitch; 5 - diaphragm; 6 - ice warning unit chamber; 7 - ice warning unit; 8 - ejector.

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It is possible to separately switch on the glass panel heaters and the remaining de-icing equipment. In this case, the L.H. or R.H. CIC-90/360 generator should be cut in by operating the respective switch on the helicopter engineer's panel.

Mounted inside the glass panels are the glass panel heater automatic control unit transmitters which produce electric pulses in case of overheating thus switching off contactor 27.

The ice warning system used in the helicopter (see Fig.327) comprises pressure pick-up 3, ice warning unit 7, and ejector 8 interconnected by a system of pipelines, and the electric circuit of the warning light and pressure pick-up heater.

Pressure pick-up 3 is a streamlined chamber mounted on the helicopter port side. The holes made in the front portion of the chamber provide for communication of the latter with the atmosphere. Located inside the chamber is heating element 1.

Pressure pick-up chamber 2 is connected with ice warning unit 7 through a pipeline. The ice warning unit is provided with hermetically sealed chamber 6 housing diaphragm 5 which is connected with microswitch 4 through a mechanical device. Reacting to the air rarefaction, the diaphragm cambers thus making the microswitch contacts.

The rarefaction is created by ejector 8 installed on the cowl of the port side engine inside the engine compartment. The ejector is actuated by compressed air fed from the engine compressor. The compressed air stream passes through the ejector diffuser thus creating the rarefaction required for the operation of the ice warning unit.

The ice warning unit operates as follows: when there is no ice formed on the helicopter surfaces, the rarefaction created by ejector 8 is compensated for by the pressure of the atmospheric air passing through the holes in the front portion of pressure pick-up 3; in this case, the contact of microswitch 4 is broken.

As soon as the helicopter enters an icing zone, the holes of pressure pick-up chamber 2 are blanked off with an ice crust, and air from the atmosphere can no longer penetrate into the chamber; due to this, a rarefaction is created in chamber 6 of ice warning unit 7, and the diaphragm operates to make the contacts of microswitch 4. As the microswitch contacts are closed, light 1 (see Fig.324) comes on. The light is located on the panel in the pilots' cabin and serves to warn the pilots about the beginning of ice formation.

At the same time, pressure pick-up heating element 1 (Fig.327) is cut in, causing the ice formed on the pressure pick-up to melt, after which the warning light and the heater are switched off again. The process just described is repeated as long as the helicopter keeps flying in the zone of ice formation.

The purpose of the pressure pick-up heater is to obviate the possibility of false ice formation signals after the helicopter has already left the icing zone. Should no heater be used, the ice crust formed on the pressure pick-up in the zone of ice formation would not melt away, and light 1 (see Fig.324) would continue to burn even after leaving the zone of ice formation.

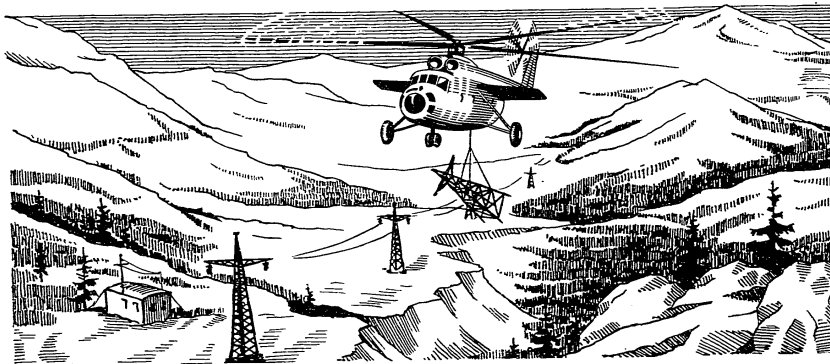
Due to the fact that the air is forced through the pressure pick-up, the ice warning unit needs no ram air flow for its normal operation and is capable of performing its function both during the flight, when hovering, and when on the ground.

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Chapter XIII

HELICOPTER SLING SYSTEM

The helicopter is equipped with a special sling system used for outboard attachment and transportation of bulky loads.

Basic Specifications

Effort at which engaging lock is disconnected
from sling shoe 350⁺⁵⁰ kg
-30

Length of MIII^1 -3 winch wire rope extension 40 m, approx.

Effort to be applied to load release handle . . . 20 kg, max.

P r i n c i p l e o f o p e r a t i o n . The loads may be attached to the sling manually by suspending them from hook 9 (Fig.328), and can be removed from the hook with the helicopter hovering at some distance over the ground.

Should it become necessary to suspend bulky loads with access to hook 9 being difficult, cargo 11 can be attached to sling 10 with the aid of the wire rope wound about the drum of winch 1. To decrease the wire rope extension and retraction rate, use is to be made, in this case, of only one winch motor.

In order to hook up the load, the helicopter is landed beside or behind the load, and the winch wire rope along with engaging lock 4 is extended to be secured manually to the shoe of sling 5. After the machine takes off to hover above the load, winch 1 (Fig.328) is out in for retracting the wire rope thus bringing the load closer to the helicopter. At the end of the wire rope stroke, engaging lock 4 comes up against limit switch 17 (see Fig.329), and the latter automatically disengages winch 1 (Fig.328). At the same time, solenoid-controlled valve 3 (Fig.309) operates to feed fluid into union II of hydraulic cylinder 22 (see Fig.329). On entering the cylinder, fluid causes rod 20 to extend and shift arm 11 with the help of lever 14 through the idle position, thus locking sling shoe 1 in the lock.

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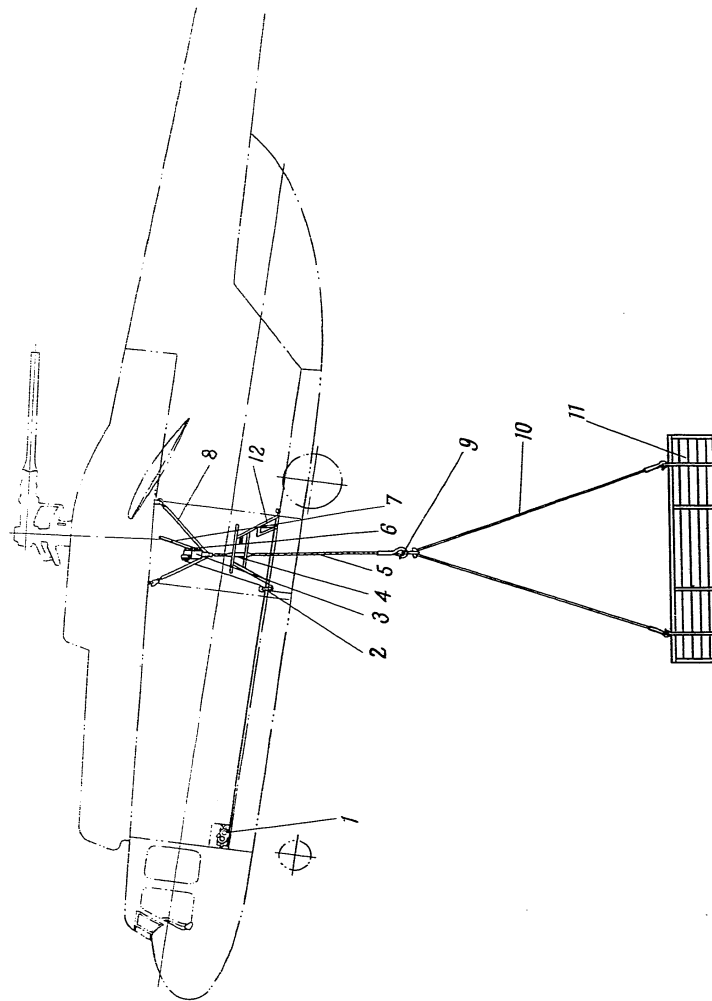


FIG. 328. DIAGRAM OF HELICOPTER SLING SYSTEM
 1 - winch; 2 - side pulley; 3 - locks; 4 - engaging lock; 5 - sling; 6 - hydraulic cylinder; 7 - cargo emergency release handle;
 8 - brace strut; 9 - hook; 10 - cargo sling; 11 - cargo; 12 - guard.

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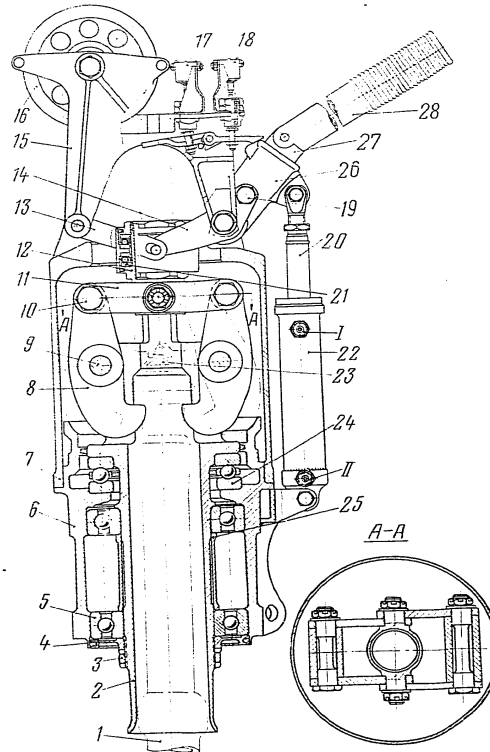


FIG. 329. LOCK WITH HYDRAULIC CYLINDER

1 - lock opening union II - lock closing union
 1 - sling shoe; 2 - tube; 3 - nut; 4 - nut; 5 - ball bearing;
 6 - liner; 7 - cast housing; 8 - hook; 9 - axle; 10 - bolt; 11 - arm;
 12 - sleeve; 13 - arm; 14 - lever; 15 - bracket; 16 - pulley;
 17 - limit switch; 18 - limit switch; 19 - bolt; 20 - rod;
 21 - thrust ball bearing; 22 - hydraulic cylinder; 23 - sling
 head; 24 - thrust bearing; 25 - distance sleeve; 26 - socket
 for cargo release handle; 27 - hinged head of cargo release
 handle; 28 - cargo manual release handle.

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The electrically-controlled winch is operated from the helicopter with the aid of a portable control panel. With the lock closed, the green light comes on due to action of limit switch 18 thus indicating that the load suspending operation is over.

In case of sharp jerks of the helicopter, forces may arise in the winch wire rope which exceed 350^{+50}_{-30} kg; this may result in rupture of the winch wire rope. To avoid such an occurrence, use is made of a special device which automatically releases sling head 23.

If necessary, the load may be released while in flight, for which purpose it is required to push the tactical release button located on the L.H. collective pitch - throttle control lever or to depress the emergency release button located on the same lever.

In case the hydraulic system fails in operation (there is no pressure in the auxiliary system), the cargo may be released manually by opening hydraulic valve 2 (see Fig.309) which is located on a panel mounted on brace struts 8 (Fig.328) and by turning cargo emergency release handle 7 downward.

CONSTRUCTION OF SLING SYSTEM

The helicopter sling system (Fig.328) consists of a lock with a hydraulic cylinder mounted on four brace struts 8. Installation of the system is facilitated by the use of eye bolts screwed into the brace struts and secured to the fuselage attachment fittings with the help of universal joints. Fastened to the front portion of the cargo compartment floor is electrically controlled winch JIII-3 which serves for loading special cargo into the helicopter cargo compartment; the same winch is also used for hooking up the cargo. When the winch is used for placing the load into the helicopter sling, its wire rope is passed over side pulley 2 and through lock 3; this done, the end of the wire rope is fitted with engaging lock 4 which, in turn, is connected to the shoe of sling 5 terminating in hook 9.

Safety during operation of the sling system is ensured by the use of a guard (Fig.330) formed by a truss welded from steel tubes and secured to the cargo compartment floor with the aid of brace rods 3. Rods 2 of the guard keep doors 4 of the hatch in the cargo compartment floor open. Installed on outboard brackets just under the hatch is a guard ring made from tubes and intended to protect the sides of the hatch and the sling system wire rope against mechanical damage (see Fig.63).

While in service, elimination of slackening of the winch wire rope and its correct winding on the winch drum are ensured by tightening the rope manually with an effort of 5 to 10 kg.

CONSTRUCTION OF LOCK WITH HYDRAULIC CYLINDER

The lock (see Fig.329) comprises liner 6 with eight lugs for the attachment of four brace struts and two lugs for the attachment of the hydraulic cylinder. Inserted into liner 6 is tube 2 carried in thrust bearing 24 and two radial ball bearings 5. Secured to the upper part of tube 2 are two hooks 8 interconnected by arms 11. The middle hinge of the arms is connected with hollow sleeve 12 mounted on top of which is a coupling with ball bearings 21 and lever 14. The latter is

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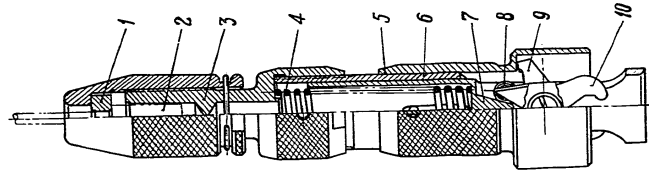


FIG. 331. ENGAGING LOCK FOR CARGO SLING

1 - washer with slot; 2 - winch wire rope shank; 3 - guide; 4 - spring; 5 - coupling; 6 - body; 7 - wedge; 8 - pulley; 9 - pusher; 10 - grip.

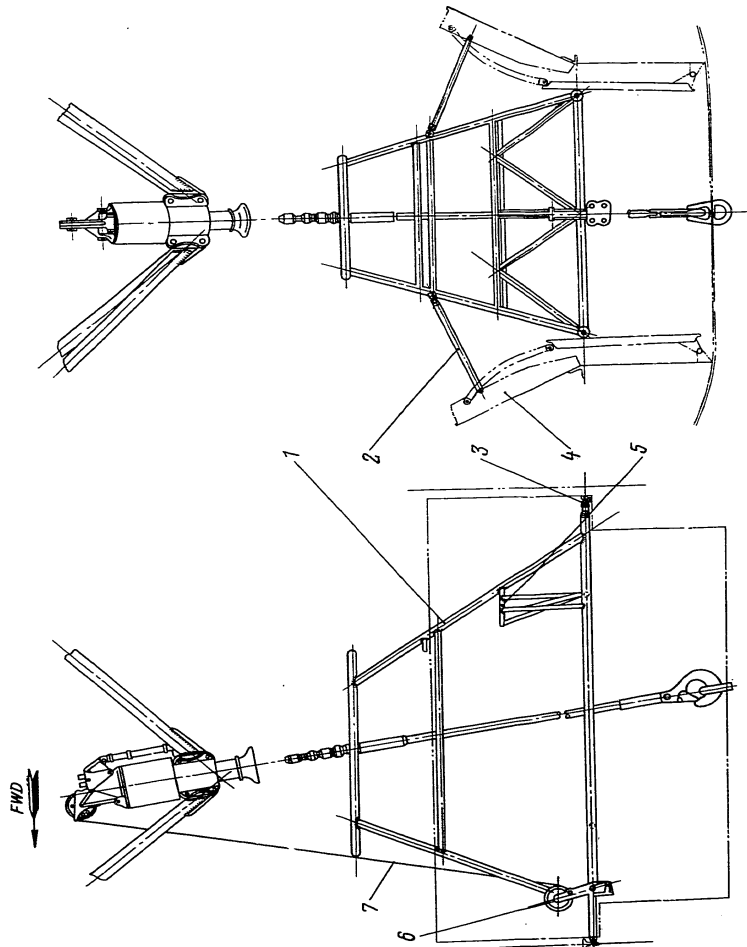


FIG. 330. HELICOPTER SLING SYSTEM GUARD

1 - guard; 2 - rod; 3 - brace rod; 4 - hatch door; 5 - step; 6 - side pulley; 7 - winch wire rope.

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articulated to cast housing 7 and connected through an eye with rod 20 of hydraulic cylinder 22. The bottom part of the hydraulic cylinder is secured to liner 6. Made on lever 14 is a socket for cargo manual release handle 28. Hooks 8 serve to lock sling shoe 1.

Housing 7 carries bracket 15 along with pulley 16 and two limit switches 17 and 18. The winch wire rope is passed over pulley 16 to be terminated in the engaging lock (Fig.331). This lock serves to receive sling head 23 (see Fig.329) that is fixed in grips 10 (see Fig.331).

The hydraulic cylinder is provided with a ball lock which keeps the piston in the upper position when there is no pressure in the auxiliary hydraulic system. The ball lock opens automatically during cargo manual release when an effort of 10 kg is applied to the end of the release handle.

P r i n c i p l e o f O p e r a t i o n . As soon as fluid under pressure (position II, Fig.309) is applied to union I of cylinder 22 (Fig.329), rod 20 is caused to move downward and turn lever 14 which raises sleeve 12 and places arms 11 out of their idle position. At the same time, hooks 8 are caused to move apart thus releasing the sling head and dropping the cargo.

The lock is closed when fluid is directed into union II. In this case, rod 20 is forced out of the cylinder to move arms 11 through sleeve 12 below the idle position, i.e. the middle hinge is caused to move by 1 to 1.5 mm below the axis connecting the extreme hinges of arms 11. With the parts so positioned, the weight of the cargo facilitates keeping the lock closed.

At the end of the lock closing stroke, sleeve 12 comes up against coupling 5 (Fig.331) of the engaging lock, making it go further downward to actuate pushers 9. The latter press out wedge 7; as a result, sling head 23 (see Fig.329) is disconnected from the engaging lock. Thus, when cargo is dropped, sling 5 (Fig.328) comes freely out of the engaging lock; due to this, neither the winch nor the wire rope experiences any jerks.

With cargo suspended from the sling system, twisting of the wire rope is avoided through use of ball bearings which ensure free turning of the entire sling along with the cargo.

ENGAGING LOCK

The engaging lock (Fig.331) consists of grips 10 which, together with wedge 7, engage sling head 23 (Fig.329) of sling shoe 1.

When some cargo is suspended from sling shoe 1, the inclined surfaces of sling head 23 tend to set grips 10 (Fig.331) apart thus compressing wedge 7 through pulleys 8. The wedge is kept in the extreme lower position by spring 4.

When the effort in the sling exceeds 350^{+50}_{-30} kg, the sling head forces grips 10 apart thus pressing out wedge 7; as a result, the engaging lock will automatically open, preventing rupture of the winch wire rope when the sling is drawn into lock tube 2 (see Fig.329).

To attach the engaging lock to the sling, it is required to shift coupling 5 (Fig.331) upward and turn it counter-clockwise (looking from the side of the wire rope); this position of the coupling corresponds to the open position of the engaging lock. After the engaging lock has been fitted on the sling head, coupling 5 should be turned in the opposite direction. This done, spring 4 forces wedge 7 downward thus compressing grips 10; as a result, the engaging lock is closed.

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ELECTRICALLY OPERATED CARGO WINCH AMF-3

The AMF-3 winch is arranged on the cargo compartment floor in the vicinity of frames Nos 1 and 2 (under the hinged threshold of the door leading to the crew's cabin).

The winch set comprises the following equipment: winch AMF-3, winch control box KVM-3, portable hand control panel IVM-1A with flexible cable, and winch manual drive handle.

Basic Specifications

Winch supply current D.C., 27 V $\pm$ 10%
 Rated wire rope load 500 kg
 Maximum wire rope load 800 kg
 Number of wire rope extension or
 retraction rates 2
 Rate of wire rope winding around winch
 drum at rated wire rope load (with
 two motors running):
 retraction stroke at least 0.5 m/sec
 extension stroke 1.2 m/sec, max.
 Note. With only one winch motor running, the rate of wire rope motion is
 two times less, respectively.
 Working length of wire rope 50 m

**LOADING OF VEHICLES AND CARGO
INTO HELICOPTER**

The AMF-3 winch is used not only in carrying cargo on the helicopter sling system, but also in loading cargo and materiel into, and unloading them from, the helicopter through the open cargo compartment door panels with use made of ramps.

Vehicles and cargo, whose resistance to towing does not exceed 800 kg, are loaded and unloaded with the aid of the winch. Should this resistance exceed 800 kg, use is made of a respective pulley block system which is secured to a special bracket mounted between frames Nos 1 and 2.

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The Mm-6 helicopters employ two types of main rotor blades: rectangular blades with honeycomb filler and trapezoidal blades of a framework structure.

Both type blades are completely interchangeable. Any Mm-6 helicopter may be equipped either with a set of rectangular blades or with that of trapezoidal blades.

The present Supplement contains the description of framework trapezoidal blades.

The flying and aerodynamic characteristics of a Mm-6 helicopter equipped with a set of trapezoidal blades are given in Book I of the Helicopter Description.

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MAIN ROTOR WITH TRAPEZOIDAL BLADES**Basic Specifications**

Main rotor diameter	35 m
Number of blades	5
Direction of rotation	counter-clockwise (looking from main gear box)
Blade form (if viewed from above or below)	along blade sections Nos 2 to 8 - rectan- gular; from blade section No.8 to blade tip - trapezoidal
Blade profile	along blade sections Nos 2 to 21 - NACA- 230M; from blade section No.21 to blade tip - HATW
Relative blade thickness	from 17% at blade root to 9% at blade tip
Chord at $r = 0.7$	950 mm
Blade setting angle at $r = 0.7$ with respect to axes of holes for blade - to - hub attachment bolts	5°30'
Blade weight	691 kg

MAIN ROTOR BLADE

The helicopter main rotor comprises five all-metal blades fabricated with use made of glue joints. The basic structural element of the blade is the steel tubular spar secured to which with the help of special attachment units is a framework built up of twenty-six separate blade sections (Nos 2 to 27 inclusive).

The gaps between the section trailing edges are sealed with the aid of sponge rubber inserts glued on aluminum cores and inserted into the gaps. The gaps in the blade leading edge are sealed as follows: the wider flanges of the even blade sections' leading edge face partitions are stepped to receive the skin of the odd blade section leading edges.

The contact surfaces of the leading edge skins are fitted with leather spacers glued up to the partitions of the even blade sections to permit slight mutual displacement of the leading edge portions in case the blade is deformed. serve to develop a lifting power and

The blade sections ensure transmission of the aerodynamic and inertia loads onto the spar. The selected blade design provides but for minor interaction between the blade sections as the blade is subjected to bending stresses.

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BLADE GEOMETRICAL DATA

The 4830 mm-long root portion of the blade (from $r = 2650$ to $r = 7480$ mm) is rectangular if viewed from above or below and has a chord equal to 1248 mm; the tip portion of the blade is trapezoidal in shape and has a minimum chord of 620 mm as measured at the theoretical tip cross-section (see Fig.1).

The spar axis on the rectangular portion of the blade is located at a distance of 19.5% chord from the leading edge, whereas on the trapezoidal portion this value gradually decreases to 16% chord as measured at the theoretical tip cross-section.

The blade has a geometrical twist changing by the linear law from 0° at the theoretical tip cross-section to $+2^\circ 13'$ at cross-section No.15 ($r = 11,610$ mm), and further on, to $-35'$ at cross-section No.14 ($r = 11,110$ mm) and $+2^\circ 38'$ at cross-section No.2 ($r = 2650$ mm).

The blade profile from root up to $r = 14,560$ mm is the NACA-230M type, and that from $r = 15,460$ mm up to the end of the blade, the HAIM type with a smooth transition from one profile to the other on the stretch between $r = 14,560$ mm and $r = 15,460$ mm.

The relative thickness of the profiles changes from root to tip (depending to some extent on the spar height); the maximum relative profile thickness at the root is equal to 17%, and the minimum thickness at the theoretical tip cross-section, to 9%.

Due to the fact that the spar is of the composite design to facilitate its manufacture, the blade profile at the tube joints (sections Nos 7 and 14) is of somewhat greater thickness and has a smooth transition to the profiles of the adjacent sections.

SPAR

The blade spar is composed of three tubes (Fig.2). The root and middle tubes are machined taper tubes made from grade OXH3M2A steel, with a varying wall thickness; the tip tube is cold-rolled from 30XICA steel with an upset root portion and varying wall thickness and cross-section. The portion of the tip tube near the flange, by means of which it is connected to the middle tube, is machined. This tube has a round cross-section changing into an elliptical one towards the end of the tube.

The blade attachment lug (Figs 3 and 4) is made from grade OXH3M2A steel and fitted on the root tube so that the centrifugal force of the blade is transmitted to the endpiece of the root tube ^{through} flange, whereas the blade torque is taken up mainly by the friction over the tube flange and by eight pins which fix the relative angular position of the tube and blade attachment lug.

Axial displacement of the blade attachment lug with respect to the spar is limited by a spring ring inserted into the lug. The bending moments in the spar root portion are taken up in the attachment lug by two supports: by the tube flange and by the band on the tube arranged near the thin end of the attachment lug. The latter support is fitted with a split cone.

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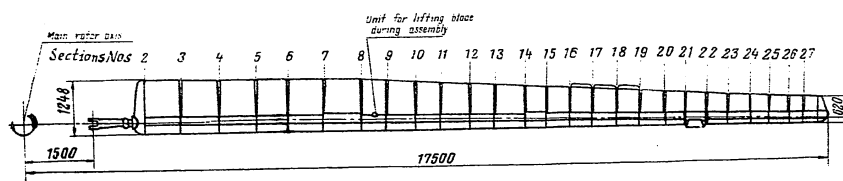


FIG. 1. GENERAL TOP VIEW OF MAIN ROTOR BLADE.

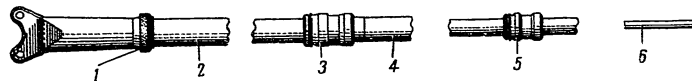


FIG. 2. BLADE SPAR
1 - blade root attachment fitting; 2 - root tube; 3 - middle joint; 4 - middle tubes; 5 - tip joint; 6 - tip tube.

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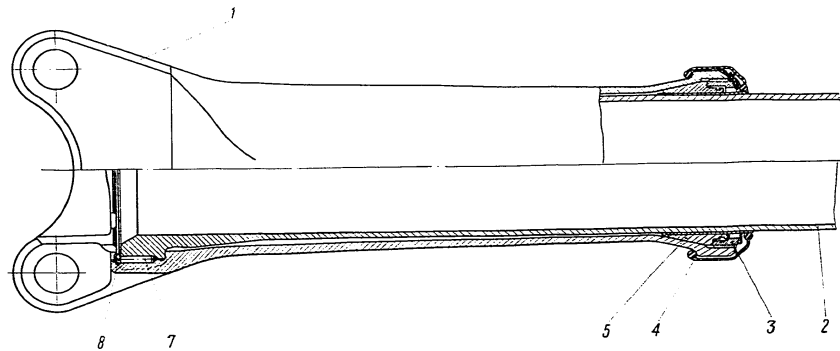


FIG. 3. BLADE ROOT ATTACHMENT FITTING
1 - blade attachment lug; 2 - root tube; 3 - coupling nut; 4 - sealing casing; 5 - split cone;
7 - pin; 8 - spring ring.

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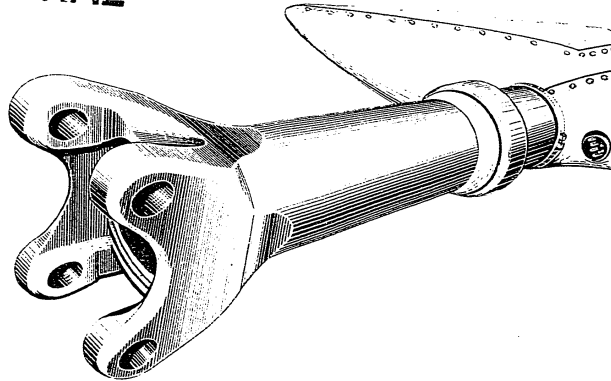


FIG.4. BLADE ROOT ATTACHMENT FITTING.

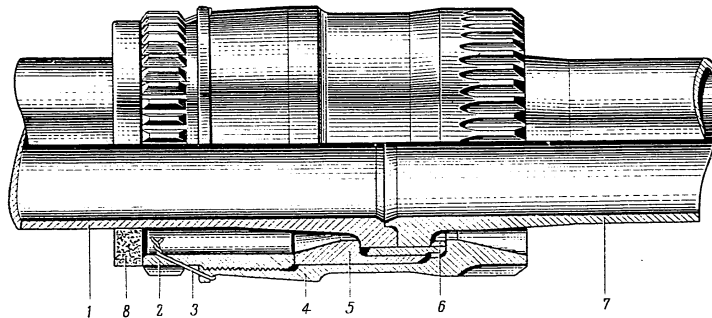


FIG.5. SPAR MIDDLE JOINT
1 - root tube; 2 - threaded ring; 3 - locking piece; 4 - body; 5 - split
ring; 6 - ring with splines; 7 - middle tube; 8 - foamed plastic
plug.

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Tightening the nut in the attachment lug results in axially displacing the cone and taking up the clearances.

The middle and tip joints of the spar tubes are accomplished with the help of flanges (Figs 5 and 6). In these joints the flanges of the tubes to be connected are tightened up during assembly with the application of a great effort causing such stresses in the tube joint which considerably exceed the stresses liable to arise during blade operation. Due to this, the threaded elements of the joints are practically free of alternating stresses. The inner cavities of threaded rings 2 of both joints are closed on the side of the blade root with foamed plastic plugs.

During the spar assembly, the tightening effort is checked by measuring the stresses in the bodies of the joints, for which purpose use is to be made of tension transmitters. Besides, the joint bodies are measured for elongation after the joint has been finally tightened up. The stresses in the joint bodies during tightening must be equal to 40 ± 5 kg/sq.mm for the middle joint, and to 45 ± 5 kg/sq.mm, for the tip one.

The mutual position of the tubes is fixed with the help of splines in the middle joint, and keys, in the tip joint.

To increase the dynamic strength of the root and middle tubes, their inner and outer surfaces have been cold-hardened. The tip tube is subjected to cold hardening all over its outer surface and over a 210 mm-long portion of the tube inner surface just near the flange.

BLADE SECTION-TO-SPAR ATTACHMENT UNITS

The sections are secured to the spar in the following way.

Cemented to the tube with the HY-2 glue is a steel collar with a trunnion or rest welded to it on the side facing the blade trailing edge. The trunnion is used for blade sections Nos 2 to 20, and the rest, for sections Nos 21 to 26. Attached to this collar with the aid of two steel bands is a shoe which is arranged along the blade axis. Riveted and glued to the shoe is a duralumin section bar (see Figs 7 and 8).

The shoe rests on the surface of the collar. Depending on the type of the joint, the shoe is either fitted on the collar trunnion or pressed to its rest, which permits the shoe to take up and transmit the centrifugal and vertical forces to the spar. The moments acting on the blade section are taken up by the bands. The tightening torque for the band nuts has been so selected that the tension in the bands is equal to approximately 20 kg/sq.mm.

The section bars of blade sections Nos 20 to 26 are reinforced with steel inserts. The attachment unit of blade section No.8 comprises a blade lifting unit (Figs 9, 10, and 11).

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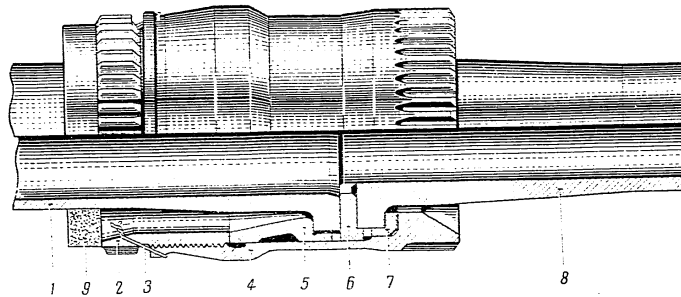


FIG. 6. SPAR TIP JOINT
1 - middle tube; 2 - threaded ring; 3 - locking piece; 4 - body;
5 - larger split ring; 6 - key; 7 - smaller split ring; 8 - tip tube;
9 - foamed plastic plug.

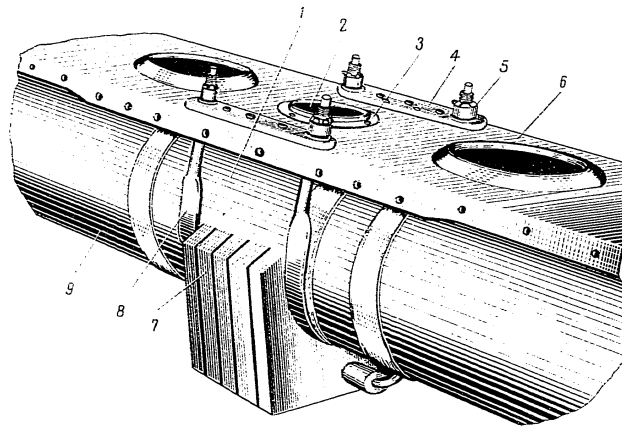


FIG. 7. STANDARD ATTACHMENT UNIT OF ROOT BLADE
SECTIONS NOS 2 TO 18 TO SPAR
1 - collar; 2 - collar trunnion; 3 - shoe; 4 - strip; 5 - nut;
6 - section bar; 7 - foamed plastic bracket; 8 - band; 9 - spar.

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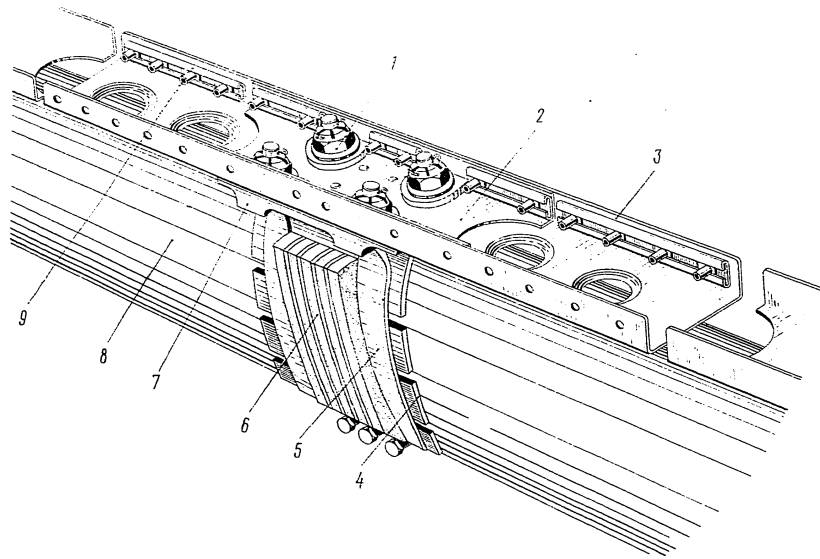


FIG.8. STANDARD ATTACHMENT UNIT OF TIP BLADE SECTIONS NOS 21 TO 26 TO SPAR
1 - nut; 2 - insert; 3 - section bar; 4 - collar; 5 - band; 6 - boss made from reinforced foamed plastic; 7 - shoe;
8 - spar; 9 - section bar with floating self-locking nuts.

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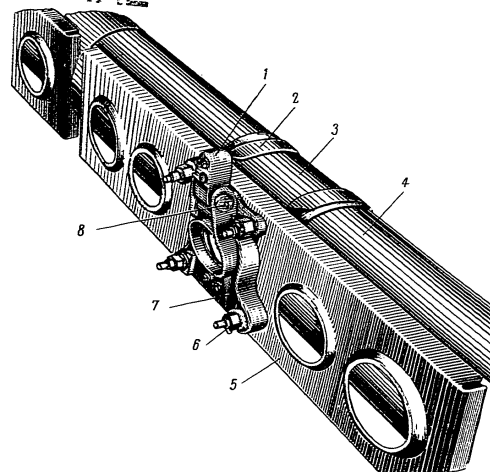


FIG. 9. ATTACHMENT OF BLADE LIFTING UNIT TO SPAR
1 - eye; 2 - band; 3 - collar; 4 - spar;
5 - section bar; 6 - nut; 7 - bracket; 8 - eye attachment bolt.

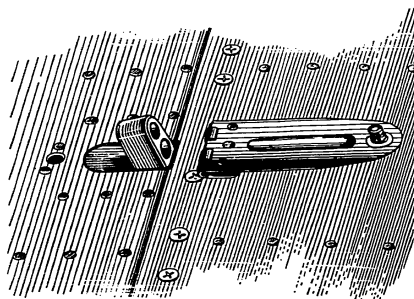


FIG. 10. BLADE LIFTING UNIT
(with access door open and eye raised).

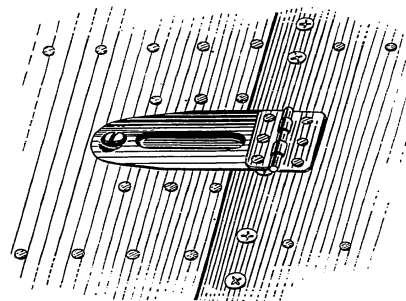


FIG. 11. BLADE LIFTING UNIT
(with eye retracted and access door closed).

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BLADE SECTION LEADING EDGES

The leading edges of blade sections are fabricated from duralumin skin 1.8 mm thick and reinforced with partitions or section bars riveted to them (Figs 12 and 13).

Riveted to the skin of blade sections Nos 2 to 20 are partitions of 1 mm-thick sheet duralumin. The parts to be riveted together are interlaid with spacers of glue film MIIQ-I. The leading edges of blade sections Nos 22 to 26 are reinforced with longitudinal section bars manufactured from sheet duralumin 1.5 mm thick; the bars are first glued to the skin with the MIIQ-I film and then secured in place by rivets.

To ensure the required blade lateral centring, steel counterweights are ^{glued and} riveted on the skin inner side in the leading edges of sections Nos 10 to 13 and 15 to 26.

At 13.2% chord, the leading edges of blade sections Nos 2 to 25 are provided with electric de-icers preventing formation of ice on the blade leading edge surface.

The de-icers are glued to the outer surface of the skin, for which purpose recesses 0.7 to 0.8 mm deep are made by chemical milling in the outer skins of the leading edges of blade sections Nos 2 to 21. No recesses for heaters are made, however, on the leading edges of blade sections Nos 22 to 25; here the entire de-icer pack is glued to the skin on top of the theoretical contour. Cemented to the skin surface with the E-2 glue is the electrical insulation comprising two layers of glass fabric saturated with the same grade glue. The electric heating element made from grade IX18H9T soft stainless steel 0.12 to 0.3 mm thick is cemented on top of the insulation layers.

The outside of the heating element is protected with insulation made up of two layers of glass fabric and with an outer skin of duralumin or avial subjected to hard anodizing.

The de-icers and the outer protective skins are fitted in place with the aid of the MIIQ-I film under a pressure of 3 to 5 kg/sq.cm and at a temperature of 150°C.

To prevent the de-icer pack against ingress of moisture, the glass fabric insulation layers on the blade section leading edges are cut 3 to 4 mm short of the faces of the leading edge skins; the slots formed between the main and outer skins are filled with glue K-153.

The contact terminals are soldered to the heater plate and brought inside the leading edge through the holes made in the skin. The terminals are additionally secured by means of threaded textolite blocks assembled with the help of glue K-153.

BLADE SECTION TRAILING EDGES

The blade section trailing edges (see Fig.1) are made up of top and bottom duralumin or avial skins reinforced with duralumin strips, cover plates, and stringers with beads, and of duralumin ribs (Fig.14).

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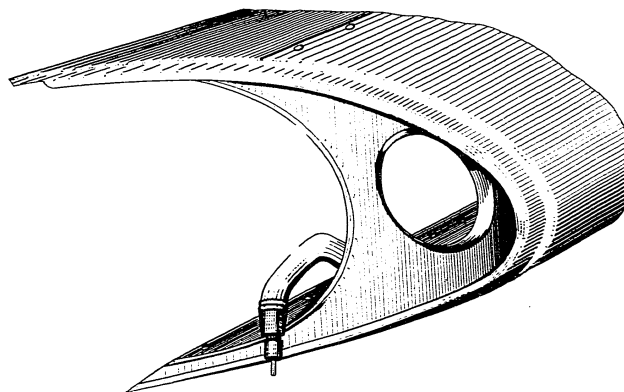


FIG. 12. BLADE SECTION LEADING EDGE WITH ELECTRICAL JUMPER FOR CONNECTION OF HEATING ELEMENTS.

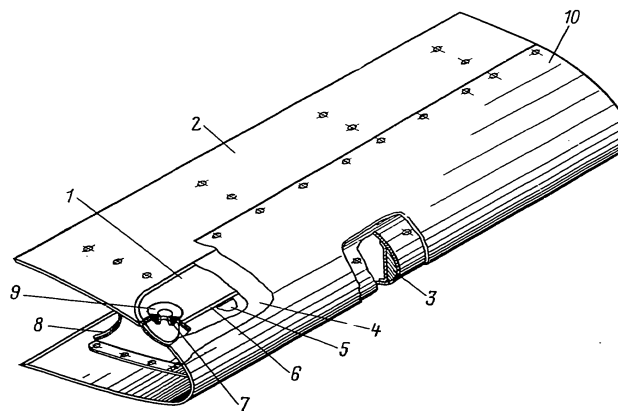


FIG. 13. BLADE SECTION LEADING EDGE WITH ELECTRIC DE-ICER

1 - heating element; 2 - skin; 3 - counterweight; 4 - insulation; 5 - insulation; 6 - gasket; 7 - block; 8 - diaphragm; 9 - terminal; 10 - outer skin.

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The skin is manufactured from duralumin or avial sheets 0.5 mm thick (with the exception of the top skins of the trailing edges of blade sections Nos 20 to 27 which are made from 0.6 mm-thick sheets).

The thickness of the skins of the trailing edges of blade tab sections Nos 16, 17, and 18 has been increased from 0.5 mm to 0.6 mm.

The trailing edges of blade sections Nos 2 to 7 have six ribs each, those of sections Nos 8 to 19 and 25 to 27, four ribs each, and those of sections Nos 20 to 24, five ribs each.

The skins of the trailing edges of blade sections Nos 2 to 14 are reinforced with glued-up strips 0.8 mm thick and stringers which are 0.5 mm thick. The skins of blade sections Nos 15 to 27 are reinforced with 0.8 mm-thick glued-up strips (sections Nos 15 to 19) and with 1 mm-thick strips (sections Nos 20 to 27), as well as with glued-up strips provided with beads 0.5 mm thick. Both the strips and the stringers are glued to the skin with the MIQ-I film which is also used to interconnect the skins, the ribs, and trailing edge stringers (with use made of rivets, too).

The trailing edges are formed by the top and bottom skins and the duralumin (sections Nos 7, 14, 16, 17, 18, 21) and textolite (sections Nos 2, 5, 8, 13, 15, 19, 25) stringers glued and riveted between them.

The trailing edges of blade sections Nos 16, 17, and 18 are provided with plate-type blade tabs (see Fig. 15). The bottom skin of each blade section has a vent hole located close to the trailing edge. The trailing edge stringers of blade sections Nos 15, 19, 20, and 21 have local widened portions with holes drilled for the weight attachment bolts; the weights are secured to the blades during the tests for flutter.

BLADE FRAMEWORK-TO-SPAR ATTACHMENT

The skins of the blade section trailing edges are secured to section bars of the blade section-to-spar attachment units with glue and rivets. Besides, the extreme ribs of the trailing edges of blade sections Nos 2 to 19 are connected to section bar side lugs by means of explosive rivets. The middle ribs are joined to section bars with the IV-2 glue and tightened up by screws with anchor nuts.

The ribs of the trailing edges of blade sections Nos 20 to 27 are connected with the aid of the IV-2 glue to the section bars and inserts through the lugs of their steel cover plates; this done, they are additionally braced up with bolts. The latter are fixed in the cover plate lugs of the ribs and prevented from falling out and turning by special clamps. The bolts are tightened up with nuts located on the outer surfaces of the section bars and shoes and locked by punching.

The leading edges of the blade sections are cemented with glue IV-2 on top of the cut portions of the trailing edge skins (the ones located over the section bars of the blade section attachment units). They are also cemented to the OK-40 foamed plastic brackets glued to the collars on the spar. The brackets of the blade sections are reinforced with plywood spacers 1.5 mm thick.

In addition to being glued to the trailing edge skins, the leading edges are secured to them by countersunk screws (Fig. 16) driven into anchor nuts that are

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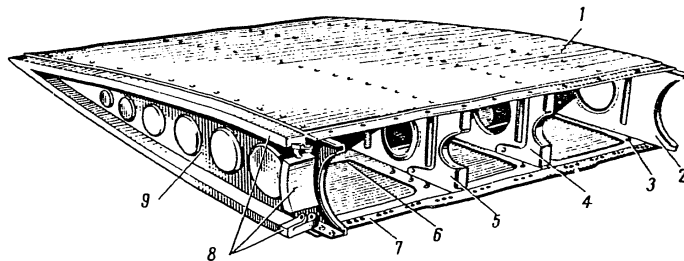


FIG. 14. BLADE SECTION TRAILING EDGE WITH SEALING INSERT
1 - top skin; 2 - extreme rib; 3 - glued-up strip; 4 - cover plate; 5 - middle rib; 6 - stringer; 7 - bottom skin; 8 - sealing sponge rubber; 9 - duralumin core.

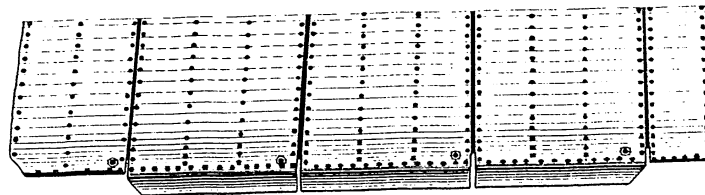


FIG. 15. TRAILING EDGES OF SECTIONS NOS 16, 17, AND 18 WITH BLADE TABS.

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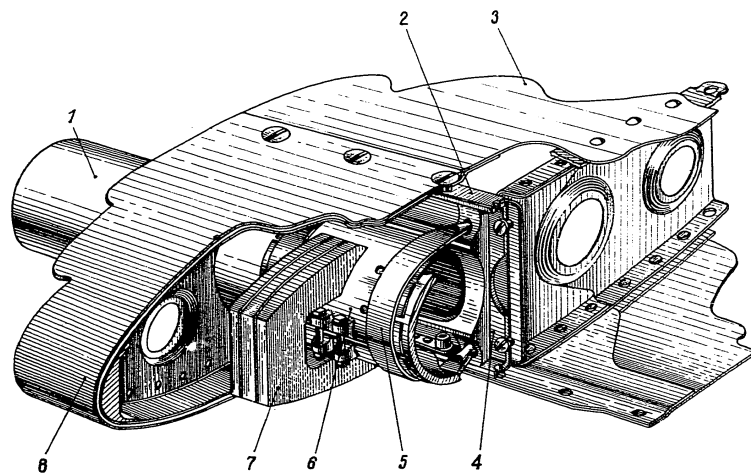


FIG. 16. BLADE SECTION ASSEMBLED ON SPAR

1 - spar; 2 - section bar; 3 - blade section trailing edge; 4 - shoe; 5 - band; 6 - collar; 7 - foamed plastic bracket; 8 - blade section leading edge.

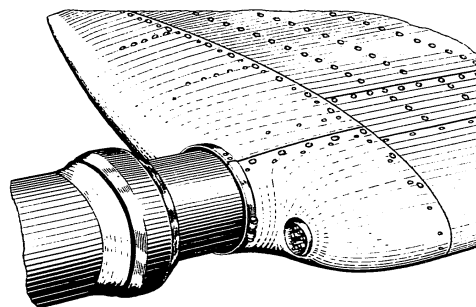


FIG. 17. EXTERNAL VIEW OF BLADE ROOT FAIRING

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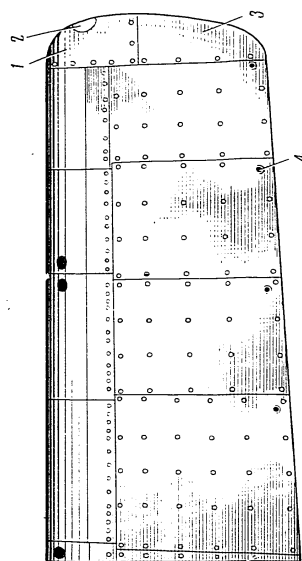


FIG. 18. BOTTOM VIEW OF BLADE END PORTION WITH TIP
1 - detachable portion of tip; 2 - blade tracking light glass; 3 - non-detachable portion of tip; 4 - vent hole.

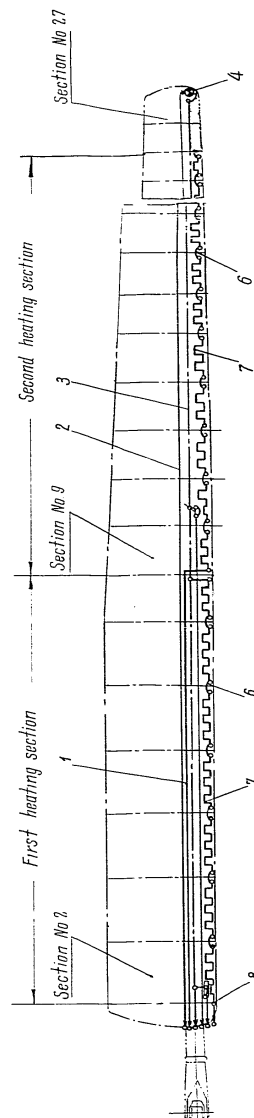


FIG. 19. DE-ICER AND BLADE TRACKING LIGHT CIRCUIT DIAGRAM
1 - supply wire to second heating section; 2 - supply wire to blade tracking light; 3 - heater frame (common grounding); 4 - blade tracking light; 5 - supply wire to first heating section; 6 - bonding jumper between blade sections; 7 - heater; 8 - supply wire to first heating section.

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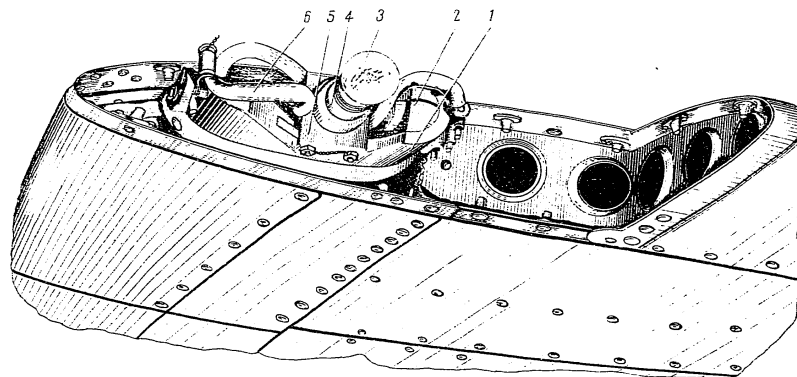


FIG. 20. BLADE TRACKING LIGHT VIEW
(with tip fairing removed)

1 - blade spar; 2 - weight support; 3 - lamp; 4 - lamp holder; 5 - bracket; 6 - electric wire.

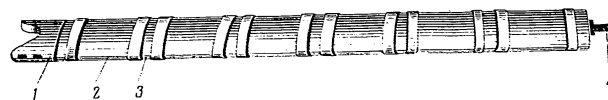


FIG. 21. WEIGHT ARRANGED INSIDE BLADE SPAR
1 - steel support; 2 - lead washer; 3 - shape nut; 4 - rod.

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riveted to the section bars, inserts, and shoes of the blade sections. In the case of blade sections Nos 15 to 19, the leading edge attachment screws are coated with glue and driven right into the shoe flanges.

Attached to blade root section No.2 with screws and anchor nuts is root duralumin fairing with a detachable leading edge (Fig.17).

The blade terminates in a detachable tip with a port made for the blade tracking light (see Fig.18); the port is glazed with organic glass.

DE-ICING SYSTEM AND BLADE TRACKING LIGHTS

The blade de-icing system (Fig.19) consists of two sections, the first section comprising the electric heaters installed in the leading edges of blade sections Nos 2 to 8, and the second one, in those of blade sections Nos 9 to 26. The positive supply wire of the first de-icer section is connected to terminal No.2 located at cross-section No.2. The supply wire of the second de-icer section is joined to the terminal of blade section No.9 located at cross-section No.9.

The negative jumper of the first de-icer section is connected to the terminal of leading edge No.8 and to the terminal block mounted on collar glued to the spar in the vicinity of blade section No.9. The negative jumper of the second de-icer section is joined to the terminal of leading edge section No.25 and to the previously mentioned terminal block in the vicinity of blade section No.9. The common negative wire is connected to the terminal block and to the plug connector located on the root blade section.

The blade section leading edge de-icers are connected to one another in series within each section with the aid of jumpers (see Fig.12).

Installed in the blade end portion under the detachable tip is the blade tracking light (Fig.20).

The electric supply wires are led to the de-icing system and blade tracking light over the spar, being secured to the latter by glass tape with the aid of glue. In the blade root the wires are terminated on a plug connector mounted on a bracket which is cemented to the spar under the root fairing (see Fig.17).

ADDITIONAL COUNTERWEIGHT, WEIGHTS, AND BALANCING DEVICES

Located inside blade section No.21 under its leading edge is an additional counterweight secured with two bolts to the steel shoes that are braced by bands to the spar collars located on both sides of the No.21 blade section attachment collar.

Placed inside the spar at the end of the blade is a weight (Fig.21) comprising a steel support, a rod screwed into it, lead washers fitted onto the rod, and shape nuts which serve to tighten up the washers. The support, lead washers, and nuts are shaped to suit the inner contour of the spar. The weight is fastened in place with four bolts passed through the spar webs and the weight support. Depending on the longitudinal balancing test results, the value of the weight in the blade may be changed to ensure the required equality of the static moment values in all blades within the given set. (23)

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Nos. off	ALTERATIONS AND SUPPLEMENTS: CHAPTERS, SECTIONS, PARAGRAPHS, ITEMS	ALTERATIONS AND SUPPLEMENTS
1.	Part II, Chapter IX. Landing Gear; Main Legs; Fig. 241	In fig. 241, assembly "C", the cardan vertical bolt design is shown. The bolt head is ear shaped to provide for the possibility of mooring main rotor blades.
2.	Part III, Chapter IX. Landing Gear; Spring Damper; Fig. 243	To increase operating reliability, the piston 9 (fig. 243) is provided with three packing rings.
3.	Part III, Chapter IX. Landing Gear; Main Leg Fairings.	In this helicopter no main leg fairings are installed.
4.	Part III, Chapter X. Hydraulic System; Hydraulic Block; Hydraulic Tanks	The hydraulic block of this helicopter carries the main system hydraulic tank and the duplicating and auxiliary system hydraulic tank. The following design alterations are introduced: a) Oil gauge glass "4" (fig. 253 and fig. 260) is mounted not at the end, but at the side wall; b) No measuring stick "22" is installed.
5.	Part III, Chapter X. Hydraulic System; Hydraulic Block; Filter Block	1. To increase operating reliability, the hydraulic block of this helicopter is provided with the main system filter block having the following design alterations: - instead of sleeve "15" (fig. 270) a split valve is mounted; - the spring "20" design is altered; - the cover "8" is of altered design, less the rod "9". 2. Type 4F22-40 coarse mesh filter is mounted on the filter block of the duplicating and auxiliary system.
6.	Part III, Chapter X. Hydraulic system; Hydraulic System Assemblies: Drain Col- lector of HM 20 Pumps.	No drain collector of the HM20 pumps is installed in this helicopter.
7.	Part III, Chapter X. Hydraulic System; Swivel Lock Control of External Cargo Sus- pension; Swivel Lock Power Cylinder.	To increase operating reliability, some alterations were introduced into the design of the swivel lock for external cargo suspension: the sleeve (fig. 310) in its upper part is similar to the sleeve 1.

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Nos. off	ALTERATIONS AND SUPPLEMENTS: CHAPTERS, SECTIONS, PARAGRAPHS, ITEMS	ALTERATIONS AND SUPPLEMENTS
3.	Part III, Chapter X. Hydraulic System. Swivel Lock Control of External Cargo Suspension. Hand-Operated Cargo Release Valve.	The hand-operated cargo release valve of this helicopter is altered: the body "3" (fig. 311) is provided with two sleeves. Therefore, the sequence of the valve operation is as follows: "When turning the handle 1 to its extreme right position for cargo release, the slide valve 4 is turned together with the handle. In this position pressurized liquid from the sleeve I is admitted to the sleeve III. When turning the handle to its initial position, the sleeve III cavity is connected with the sleeve II to drain the liquid into the tank".
4.	Part III, Chapter XII. Anti-Icing System.	To provide for normal flight in the icing zone, the electric heater anti-icing system of the tail rotor has been replaced in this helicopter by the liquid anti-icing system. The antifreeze liquid supplied to the tail rotor blades consists of a mixture of 35 per cent rectified alcohol and 15 per cent glycerine (by volume). After switching on the anti-icing system, the antifreeze liquid is supplied through the tubes to the collector. Actuated by the centrifugal forces, the liquid is supplied through the hoses to the blade channels, from which it is forced out onto the blade surfaces by the air stream through the holes. In the process of ice formation this liquid, together with super-cooled water depositing on the blade surfaces, forms a low-freezing mixture preventing from the ice accumulation. The liquid anti-icing system of the tail rotor comprises a 30 l. capacity service tank, a CMH-1 centrifugal pump, intended to supply the antifreeze liquid to the rotor blades, a throttle valve to regulate the amount of liquid supplied, a C4-1 filter to purify the antifreeze liquid and a CA-16A pressure indicator to read the amount of liquid left in the service tank.

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ITEMS

ALTERATIONS AND SUPPLEMENTS

The CUE-1 pump, the throttle valve, the Cf-1 filter and the CU -16A pressure indicator are mounted on a special panel arranged near the service tank. The panel is fastened to the ceiling by screws and anchor nuts.

The service tank is arranged on the ceiling, near the frames Nos. 26-28, between the stringers No. 1 and is fastened with steel strips and soft lining to the two detachable brackets fixed on special profiles.

The service tank is primed with antifreeze liquid either through a filler throat or by means of the PHA-1A hand-operated pump. The hand-operated pump is mounted by the user on the starboard of the cargo compartment near the frame 26, between the stringers 1B and 2C.

The pump has a flexible intake hose with a tip ended by a strainer and a pressure hose which is nut coupled to the sleeve arranged on the cargo compartment ceiling.

A pipe line with the pipe band and jet is laid inside the helicopter along the fuselage starboard, tail and keel booms. It connects the throttle valve with the tail rotor. The pipe line enters the collector-distributor. The collector has eight sleeves with flexible hoses attached through which the liquid is fed to the rotor blades (two hoses for each blade).

The anti-icing system control is effected with the help of a three-position switch mounted on the middle pilot's panel.

The system provides for three duty cycles: 20 sec., 40 sec. and 60 sec.

When the helicopter enters the icing zone, the signal lamp "icing" flashes on the middle pilot's instrument panel. By means of the three-position switch the pilot engages the anti-icing system for one of the duty cycles.

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Nos. off	ALTERATIONS AND SUPPLEMENTS; CHAPTERS, SECTIONS, PARAGRAPHS, ITEMS.	ALTERATIONS AND SUPPLEMENTS
		When shifting the three-position switch to the 20 sec. duty cycle, one simultaneously engages the main rotor electric anti-icing system which operates intermittently and the tail rotor liquid anti-icing system which operates continuously. In this case the OH 34-1 pump operates at its normal duty with 8000-8500 r.p.m. When the pump builds up the required pressure of the alcohol-glycerine mixture, the lamp "Anti-icing system on" flashes on the pilot's middle instrument panel. The above events take place when shifting the three-position switch to the 40 sec. duty cycle. When shifting the three-position switch to the 60 sec. duty cycle the pump duty is forced up to 11000 r.p.m. When the pump builds up the required pressure of the alcohol-glycerine mixture, the lamp "Anti-icing system on" flashes on the middle pilot's instrument panel. If there is no alcohol-glycerine mixture left in the service tank of the tail rotor anti-icing system, the lamp "Anti-icing system on" goes out. At this time the flight technician must pay attention to the readings of the main rotor anti-icing system ammeter. If the ammeter readings correspond to the normal operation of the main rotor system, the flight technician, in case of necessity of subsequent operation of the tail rotor anti-icing system, must replenish some mixture from the additional containers by means of the hand-operated PHA-1A pump and thus fill the service tank. Hereafter the signal lamp "Anti-icing system on" flashes again. The additional containers-canisters are placed in the cargo compartment along the starboard and the port side, between the frames Nos. 75 and 76.

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Nos. off	ALTERATIONS AND SUPPLEMENTS: CHAPTERS, SECTIONS, PARAGRAPHS, ITEMS	ALTERATIONS AND SUPPLEMENTS
10.	Part II, Chapter IV. Power Plant, Engines	To simplify maintenance, the exhaust pipes of this helicopter are easily detachable. Therefore, in the "Engines" section, after the subsection "Engines Fastening", a new subsection is added to the effect: <u>"Mounting Easily Detachable Exhaust Pipes"</u> The engine flange is fitted with the adaptor flange connecting the engine and the exhaust pipe. This flange has a tapered surface against which the exhaust pipe flange end rests. The exhaust pipe flange also has a tapered surface. At the ends of the exhaust pipe flange and the adaptor flange two pins are fitted to fix the exhaust pipe position. The flange tapered surfaces are fitted with a yoke consisting of three parts bolted together by means of special bolts. The clearance between the yoke parts should not exceed 3 mm. By means of special bolts the yoke is tightened until complete bearing against the flange tapered surfaces; then the bolts are released to eight facets (4/3 turn) to avoid the yoke breaking as a result of excessive stresses when the exhaust pipe heats up in the process of engines operation". This helicopter is provided with light indicators arranged near each filler throat. The signal lamps, which flash when the fuel tanks are primed, are arranged on the instrument panel of the flight technician.
11.	Part II, Chapter IV. Power Plant. Fuel System. Fuel Tanks Priming.	

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Nos of	ALTERATIONS AND SUPPLEMENTS: CHAPTERS, SECTIONS, PARAGRAPHS, ITEMS	ALTERATIONS AND SUPPLEMENTS
12.	Part II, Chapter IV. Power Plant, Cooling System.	In this helicopter the "562" hydraulic pumps are replaced with the H1120 pumps.
13.	Part II, Chapter V. Transmission and Fan Unit. 1. Fan Unit.	Therefore air supply pipe connections 9 (Fig. 169) intended to cool the hydraulic pumps in this helicopter are of new design with altered mounting of the air supply pipes.
14.	Part I, Airframe. Chapter I. 1. Fuselage Central Part Cargo Compartment Windows and Doors.	The front and rear entrance doors of the cargo compartment in this helicopter are not provided with hatch covers and apertures for connection of air conditioners.
15.	Part I, Airframe. Chapter I. 1. Fuselage Nose Part.	This helicopter is provided with a nose machine-gun mounting HYE-IM. Therefore, glass panel ensuring observation downward and forward is removed. A special door is provided for installing the HYE-IM mounting as well as special fittings for mounting attachment and door alaps hydraulic cylinders. The cabin layout is designed to accommodate all equipment of the mounting HYE-IM as well as ammunition equipment and the sighting device.
16.	Part II, Chapter IV. Power Plant. Fuel System. Fig. 139	To ensure better operation of the engine stop cocks the engine stop handles are provided with retainers ensuring locking of the cocks in the position CLOSED (ЗАКРЫТО).
17.	Part I, Chapter I. 7. Heating and Ventilation of Helicopter Cabins. Fig. 98	Starboard and portside blisters of the pilots' cabin in this helicopter are not provided with heating, the latter being unnecessary.
18.	Part I, Chapter I. Fuselage, Transport and Troop- Carrying Equipment. 1. Fuselage Nose Part. Figs 11, 17, 23	This helicopter is provided with navigator's cabin door emergency jettison mechanism of altered design. Contact plates are replaced with levers and adjusting screws. The miniature switches are held compressed by springs of the levers and the adjusting screws are rigidly connected with rods of the mechanism.

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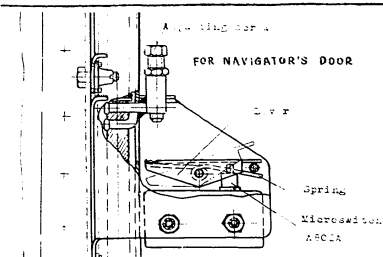
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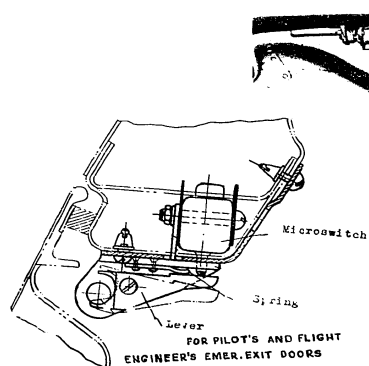
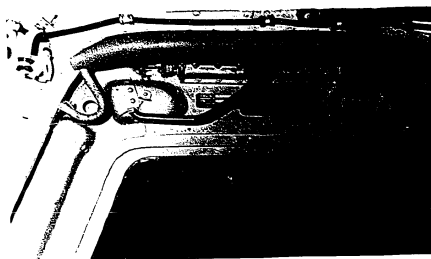
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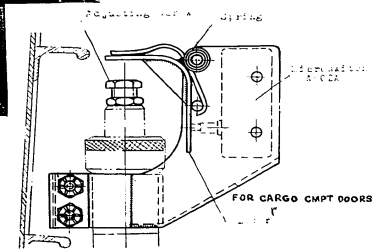
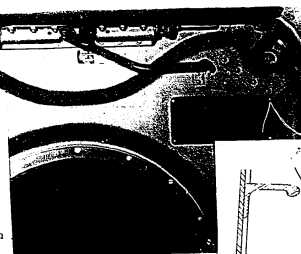
ALTERATIONS AND SUPPLEMENTS



When jettison mechanism actuates, the rod moves together with the newly introduced adjusting screw and presses the lever which releases the compressed miniature switches. The miniature switches actuate, feeding current to the pyrocartridge, and the rows of the pyromechanism knock the door out.



19. Part II. Chapter IV
Power Plant.
Fuel Tanks.



To tighten turnbuckle bolts use calibrated torque wrench with torque of 650 kg.-cm.

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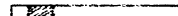
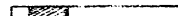
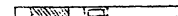
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Nos off	ALTERATIONS AND SUPPLEMENTS: CHAPTERS, SECTIONS, PARAGRAPHS, ITEMS	ALTERATIONS AND SUPPLEMENTS
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20. Part III
Chapter I
Hydraulic system
Fig.312

The marking of pipelines on the present helicopter
is carried out according to the following table:

Pipeline Name		Painting
Main servo system	Pressure line	 
	Return line	 
	Vent line	 
	Suction line	 
Duplicating servo system	Pressure line	 
	Return line	 
	Vent line	 
	Suction line	 
Auxiliary system main line	Pressure line	
	Return line	
	Vent line	
	Suction line	
Seat control		
Windscreen wiper		
External sling		
Collective pitch lever		
Ramps		
Servicing platform control: open		 
close		 
Cargo doors control: open		 
close		 
Special door opening		 
Special door closing		 
Autopilot		
Symbols for colours :  - black ring  - yellow ring  - green ring  - blue ring  - dark blue ring  - brown ring  - aluminium ring  - pink ring  - grey colour		

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Nos off	ALTERATIONS AND SUPPLEMENTS: CHAPTERS, SECTIONS, PARAGRAPHS, ITEMS	ALTERATIONS AND SUPPLEMENTS
21	Part II. Chapter VI. Helicopter Control System. Transmission Brake Control.	A pull-off pulley is introduced in the transmission brake control system of this helicopter. The pulley is mounted on frame No.8 of fuselage nose part. Besides this the bell crank on transmission brake control handle is changed. The bell crank is extended and curved. The microswitches are turned so as to assume approximately horizontal position.
22.	Part I. Chapter I. 2. Fuselage Central Part. Cargo Compartment Windows and Doors. Fig. 42	When folded up blinds of the cargo compartment windows are secured with belts.
23.	Supplement No. 1	Following the section "Additional Counter Weight, Weights and Balancing Devices" a new section is added: "Anti-Abrasion Protection of Blade Section Leading Edges" To prevent abrasive wear of blade section leading edges when main rotor operates in dusted air (sand dust), the outer skin of blade section leading edges (sections Nos 12 to 27) are protected with HC-68-1 rubber strips which are glued to the skin with K-153 glue.
24.	Part II. Chapter V. 1. Tail Gear Box. Fig. 477	This helicopter being equipped with tail rotor provided with liquid de-icing system. casing JC-7450-10 is introduced to prevent lubricant leakage through tail gear box seals from the side of the tail rotor.
25.	Part I. Chapter I. 2. Fuselage Central Part. Troop-Carrying Equipment.	In this helicopter backs of crew member seats, backs of trooper seats and storage battery compartments are lined with soft fabric of higher quality.
26.	To all Sections of the book.	Modifications of all fabricated items installed on this helicopter are enumerated in detail in the Catalogue of Main Parts and Assemblies.

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